

1/385

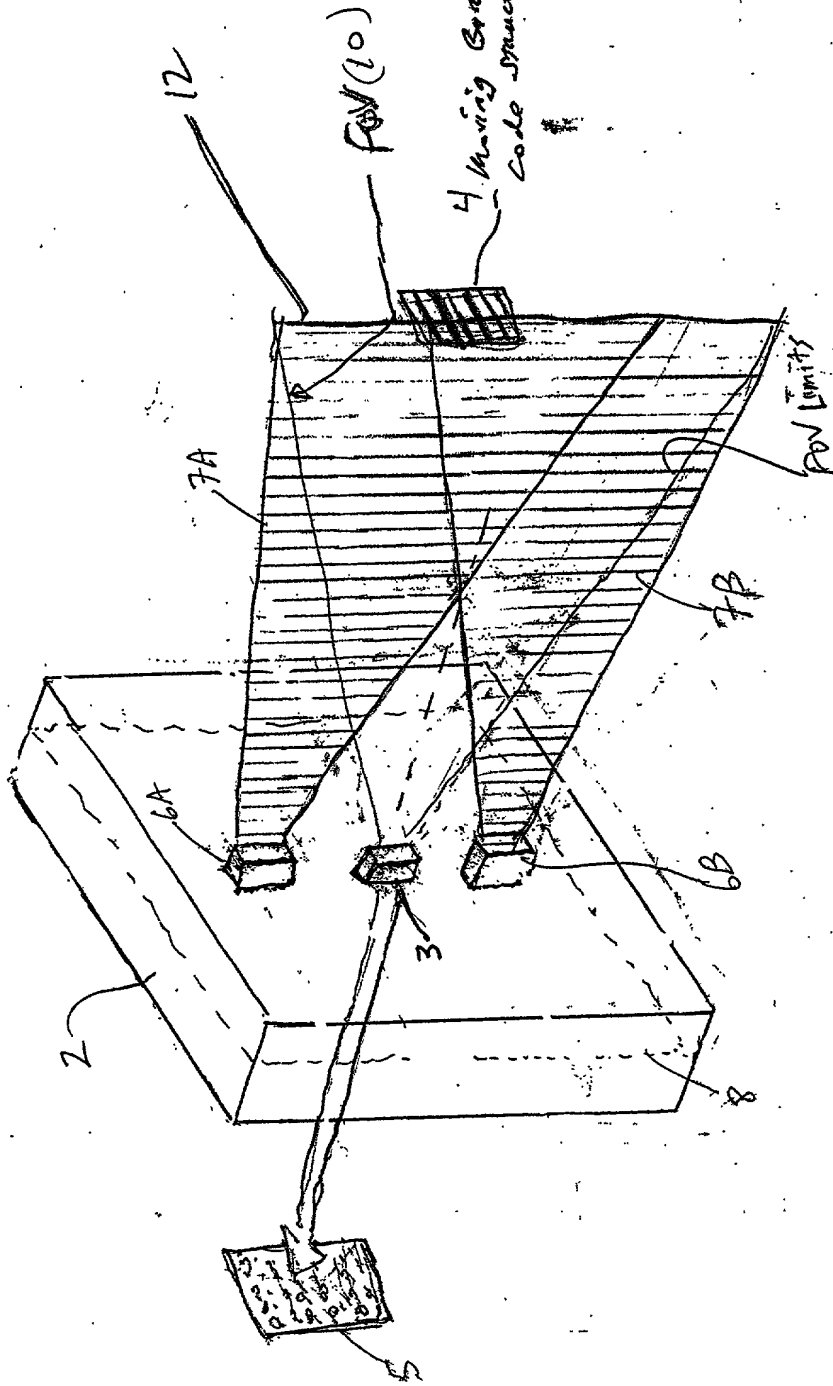


FIG 1A

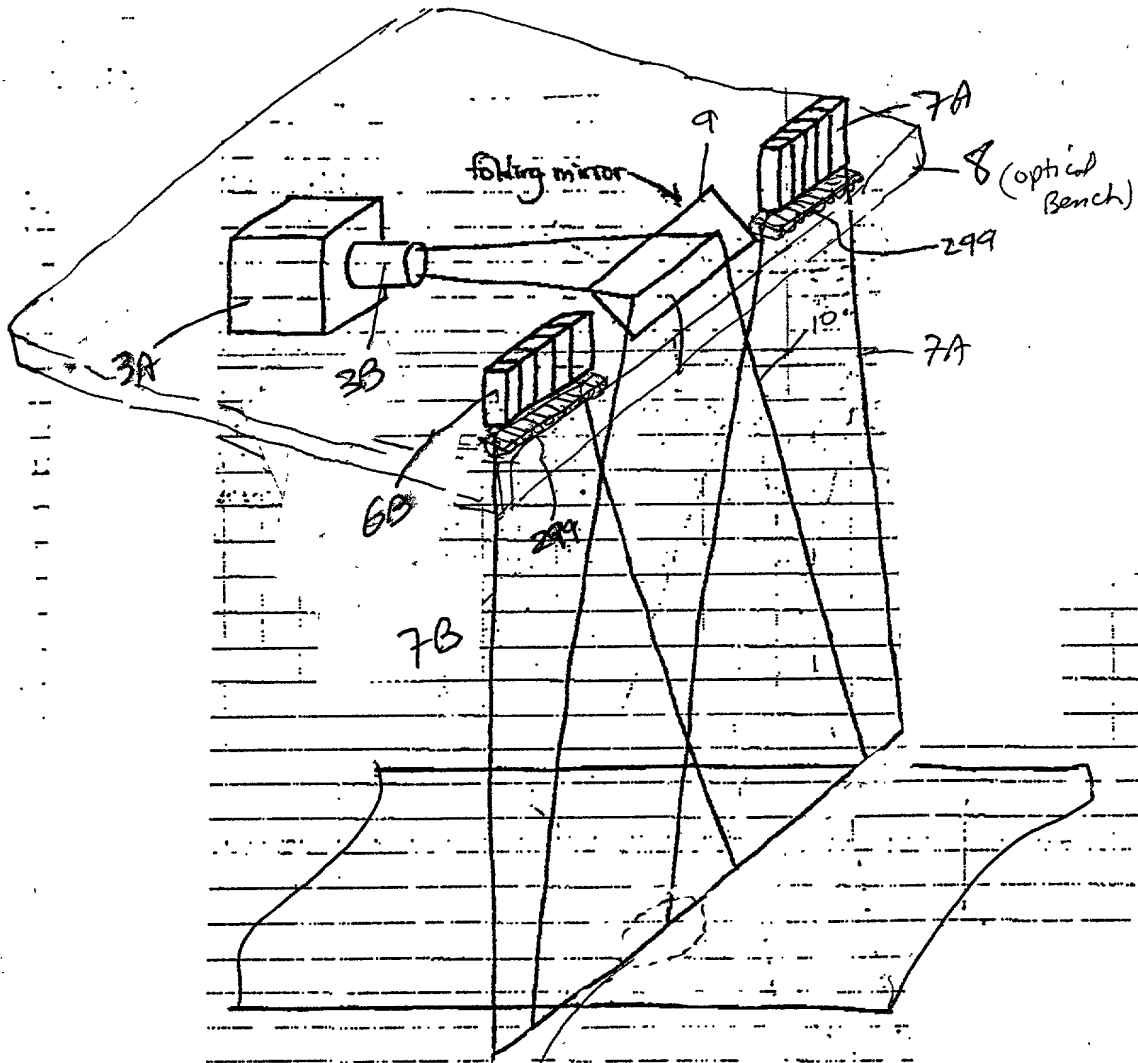


FIG. 1B1

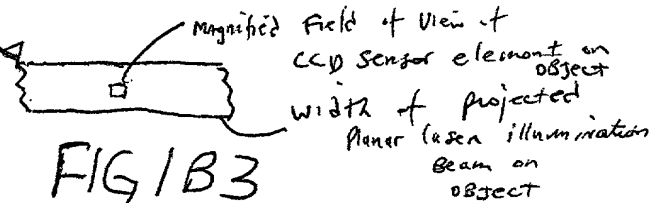
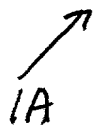


FIG 1B3

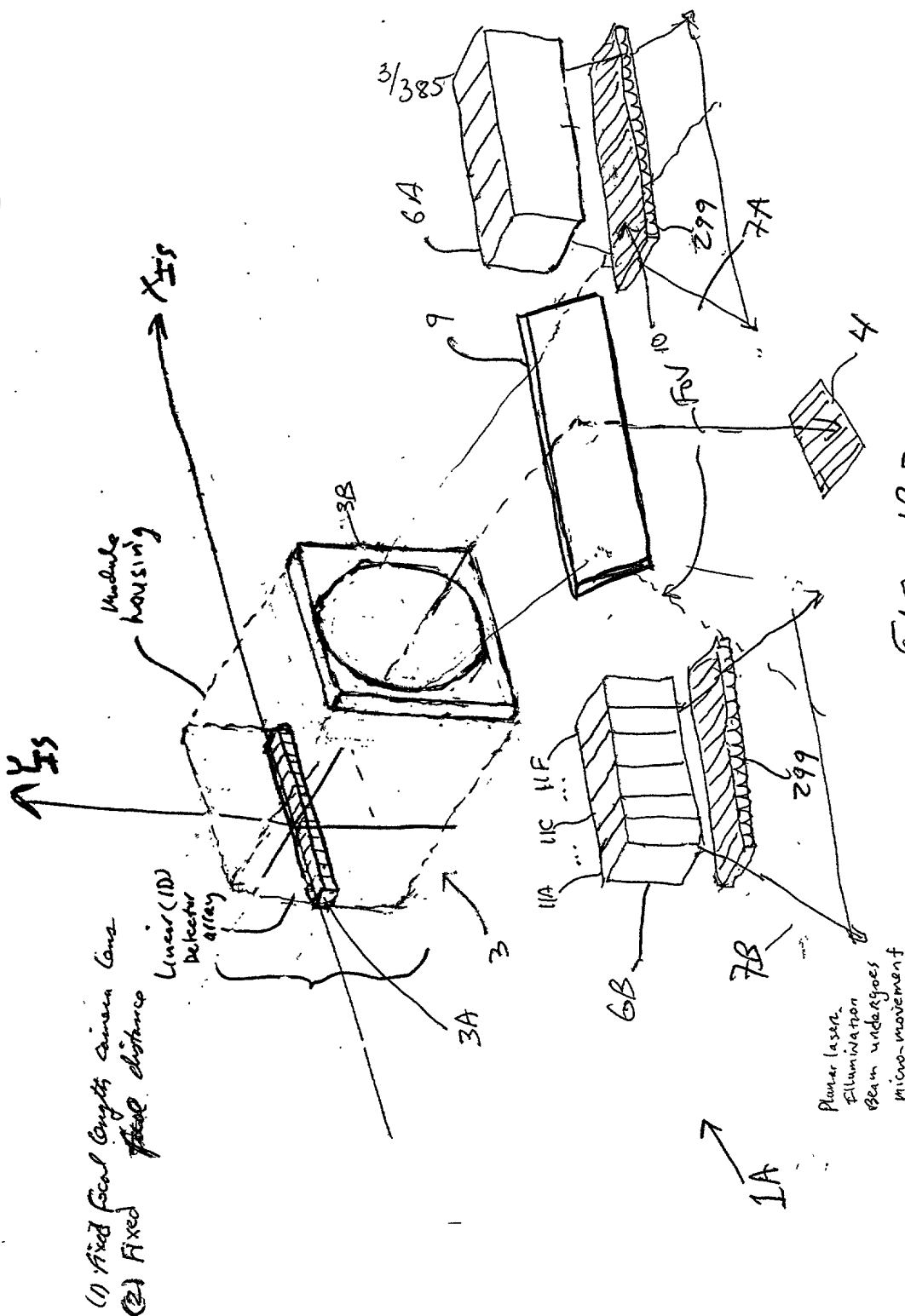
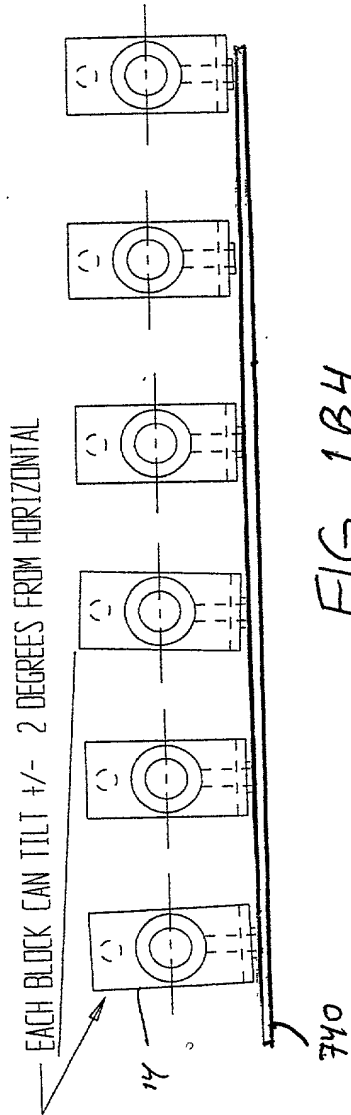
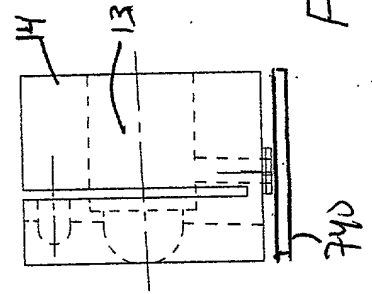
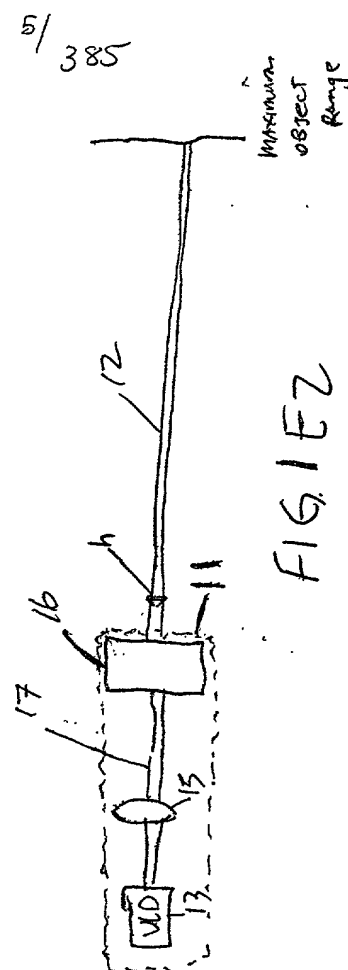
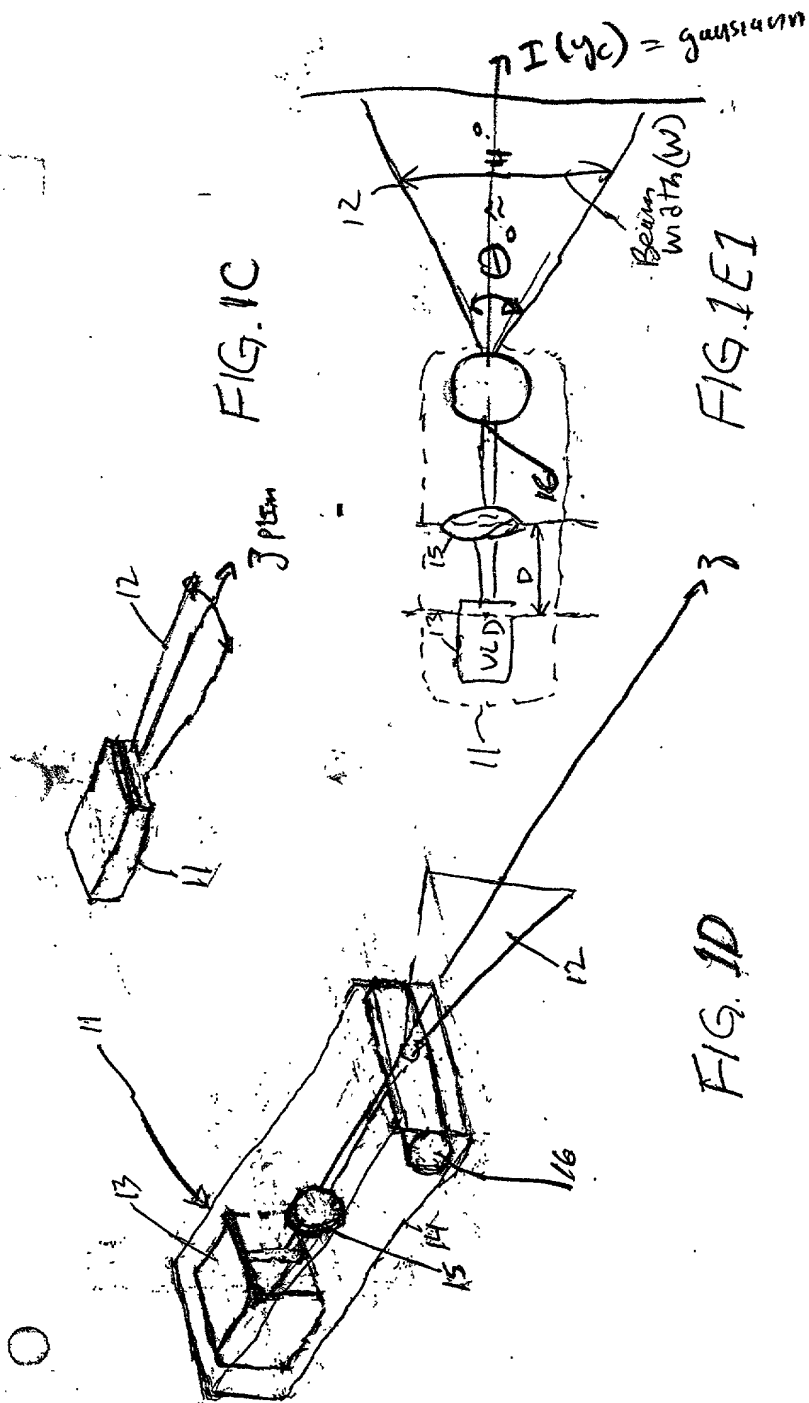


FIG. 1B2



VLD BLOCK CAN PITCH FORWARD FOR ALIGNMENT WITH OTHER VLD BEAMS





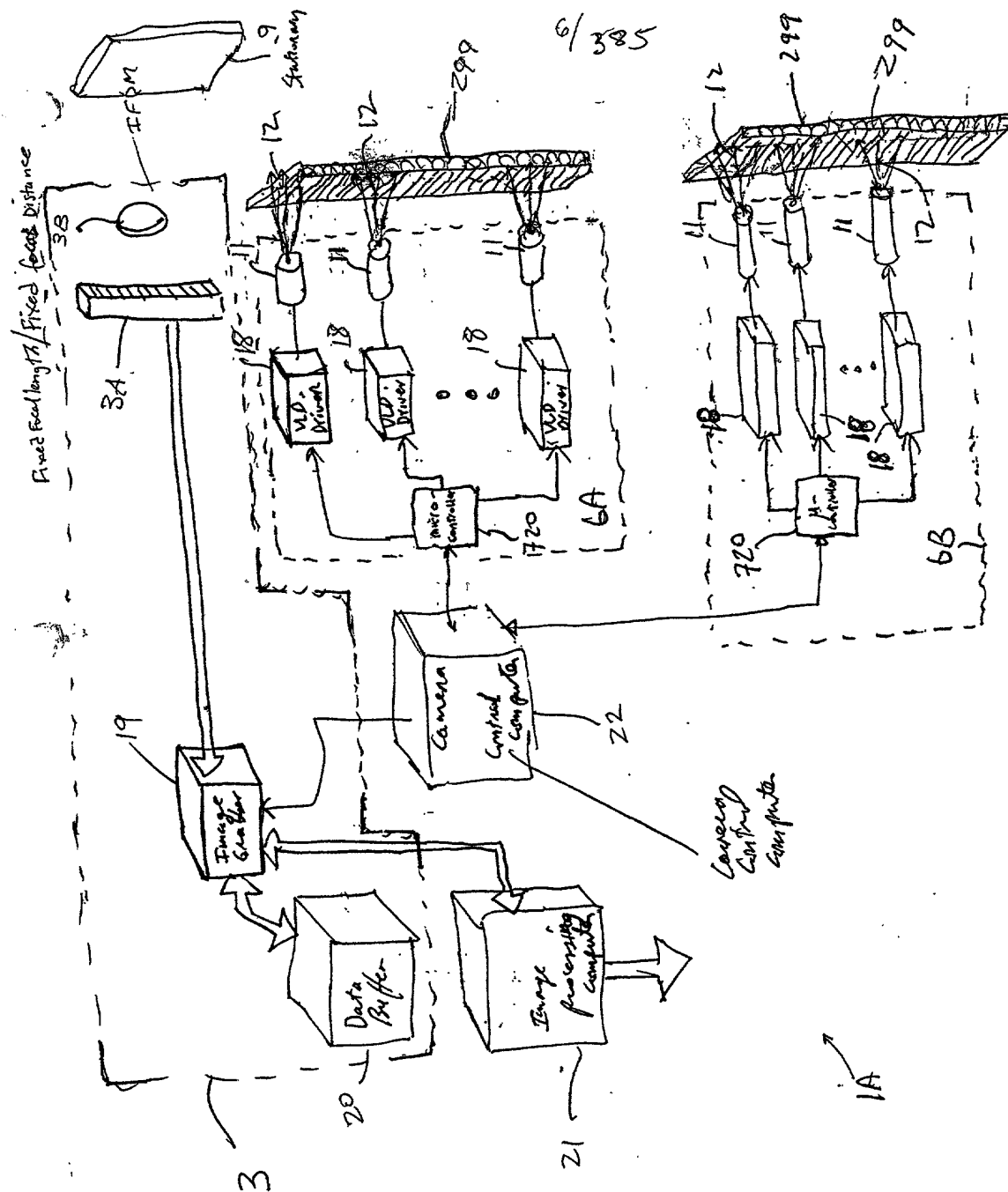
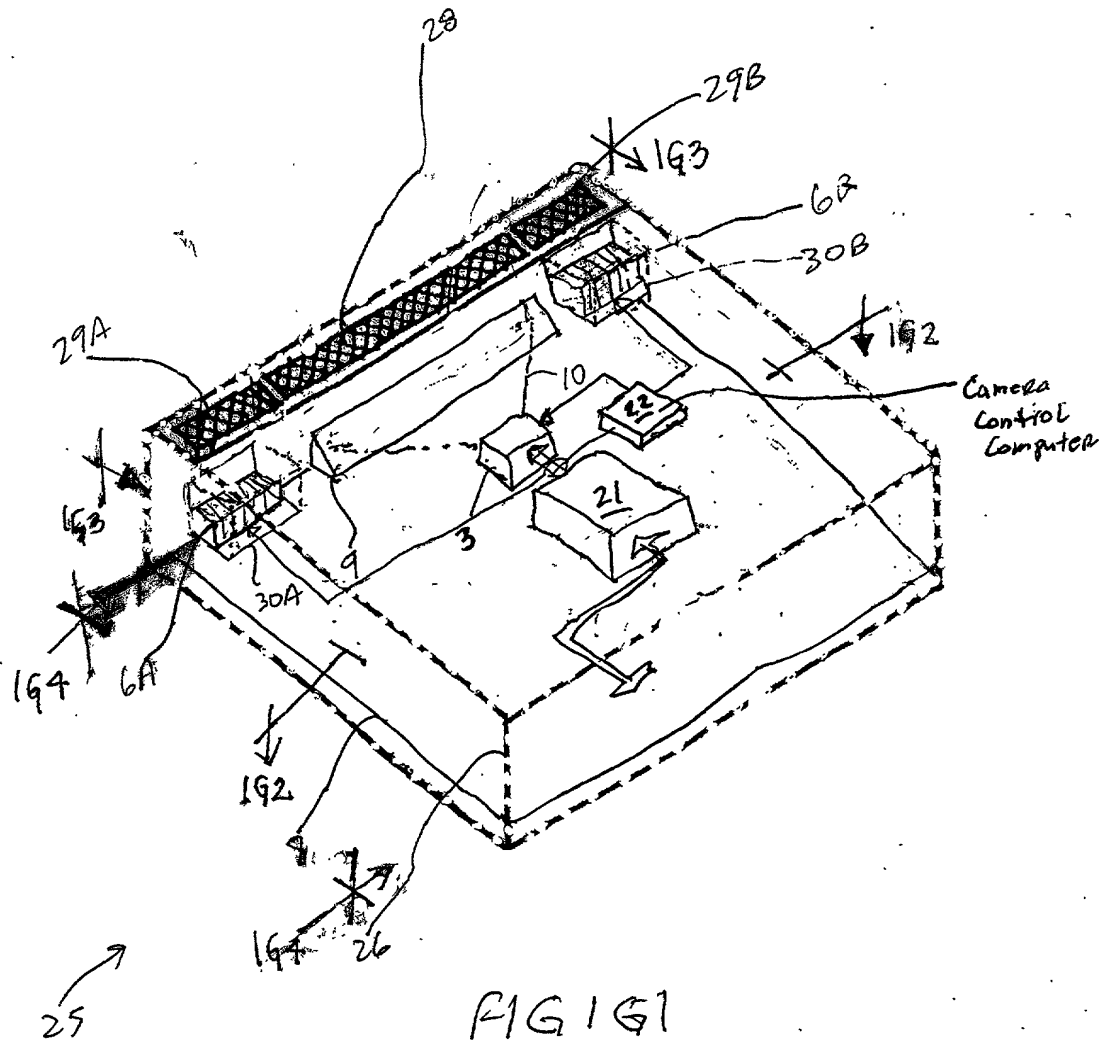


FIG. 1F

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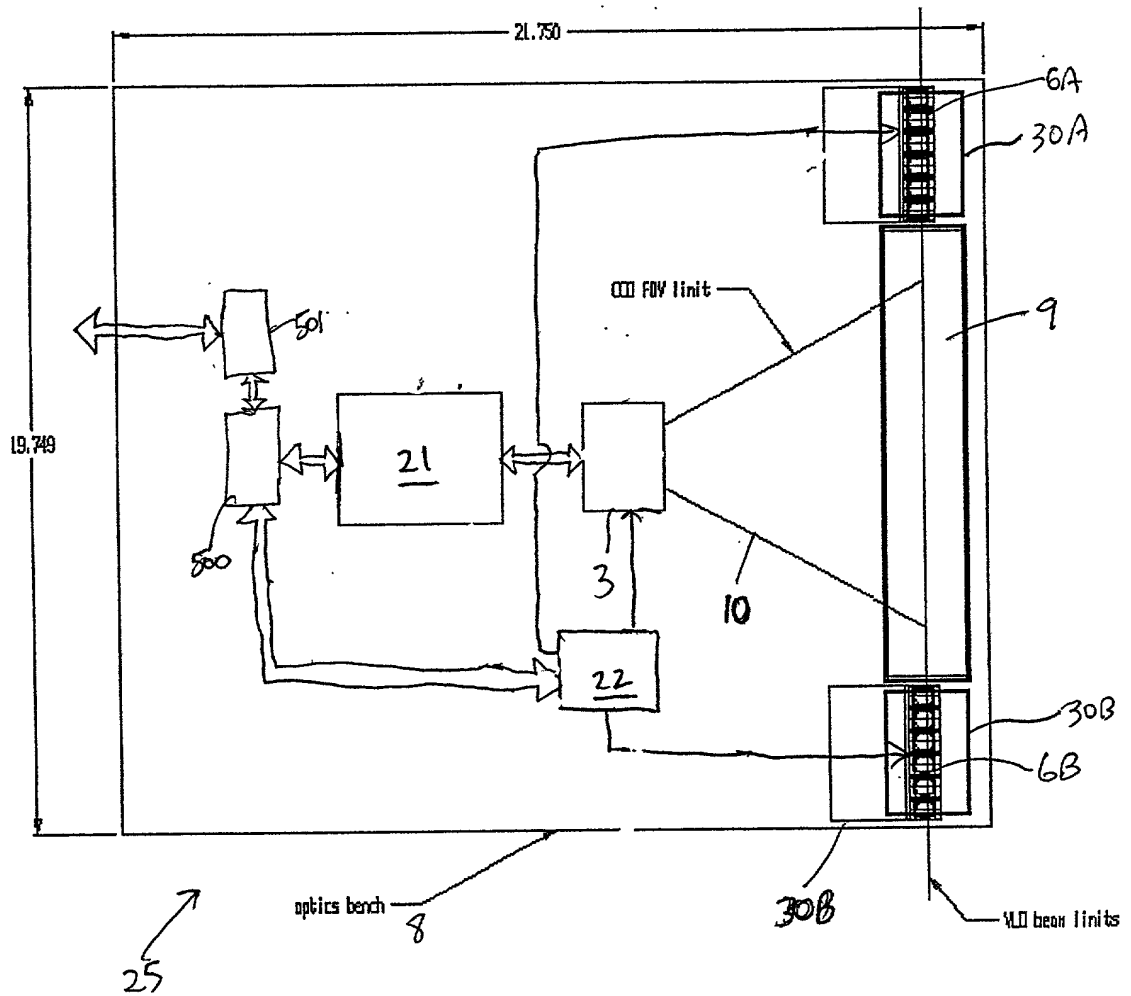


FIG. 142

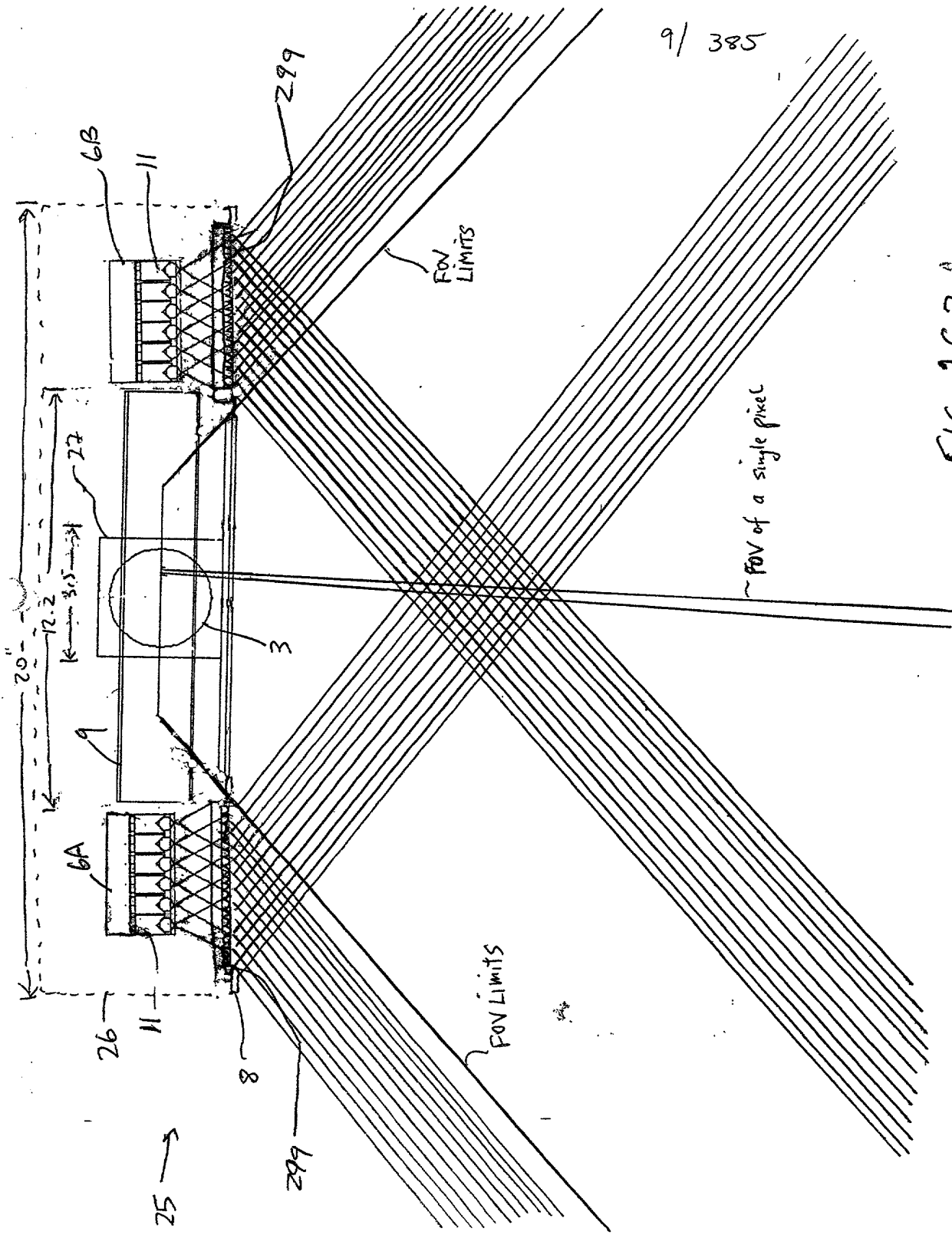


FIG. 1G3

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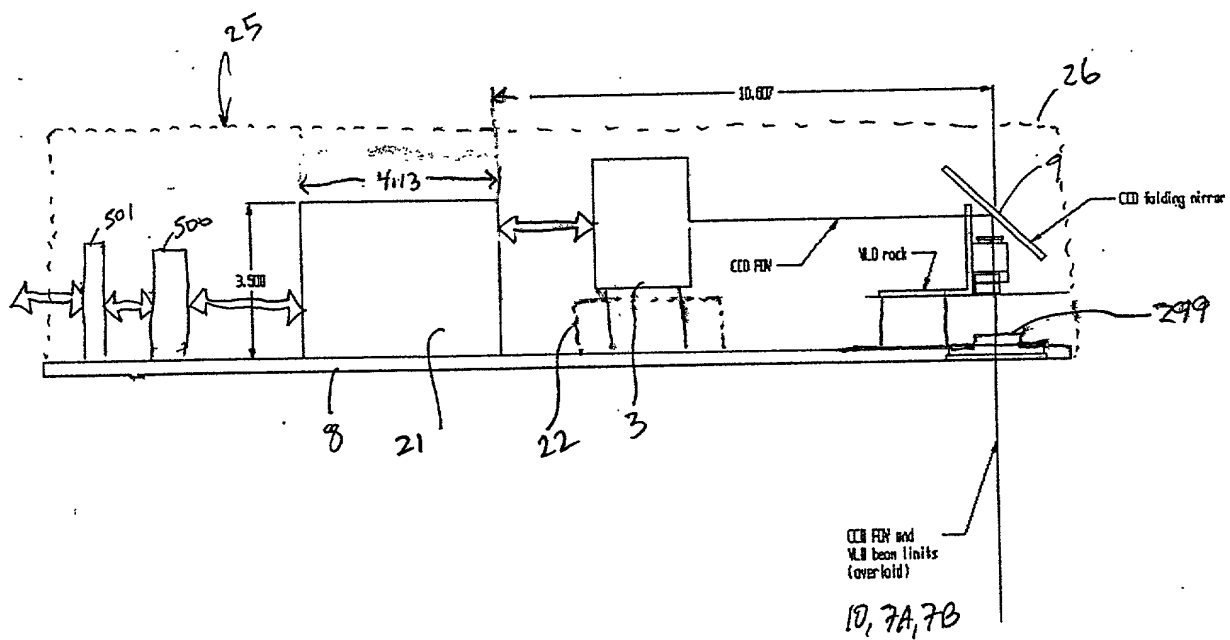
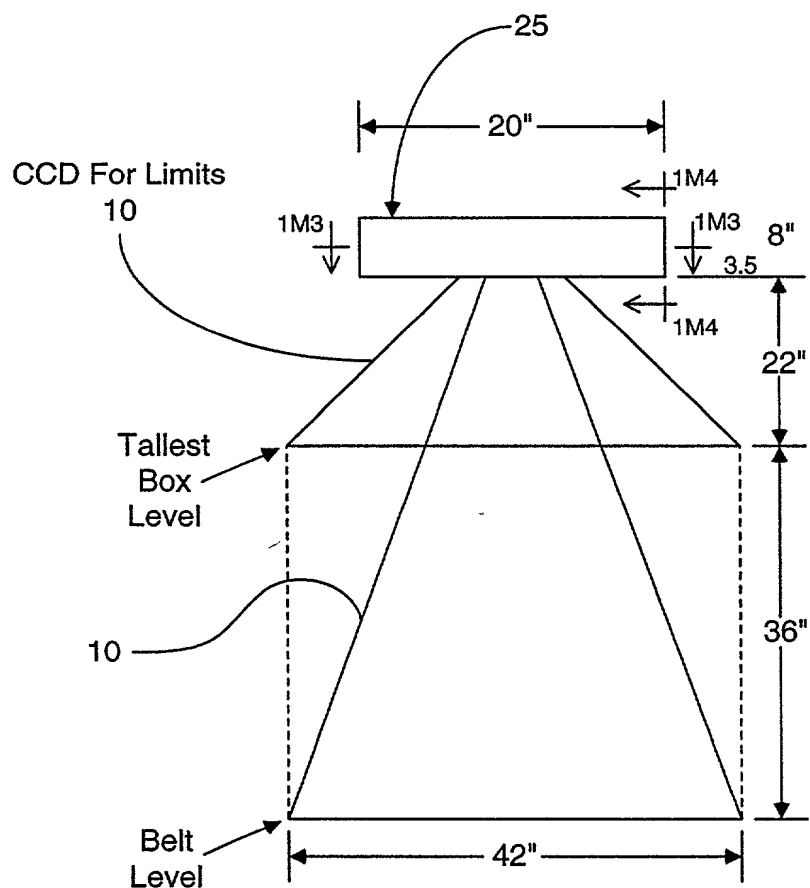


FIG. 164

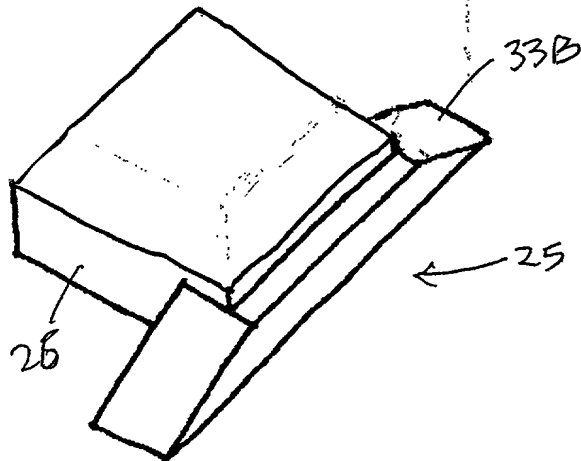
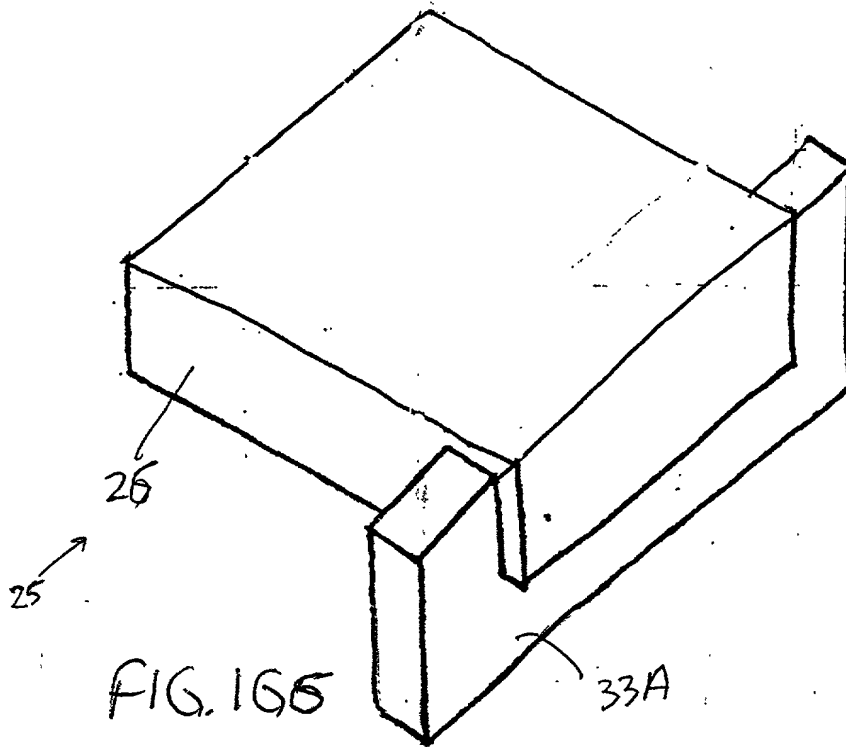
11/385



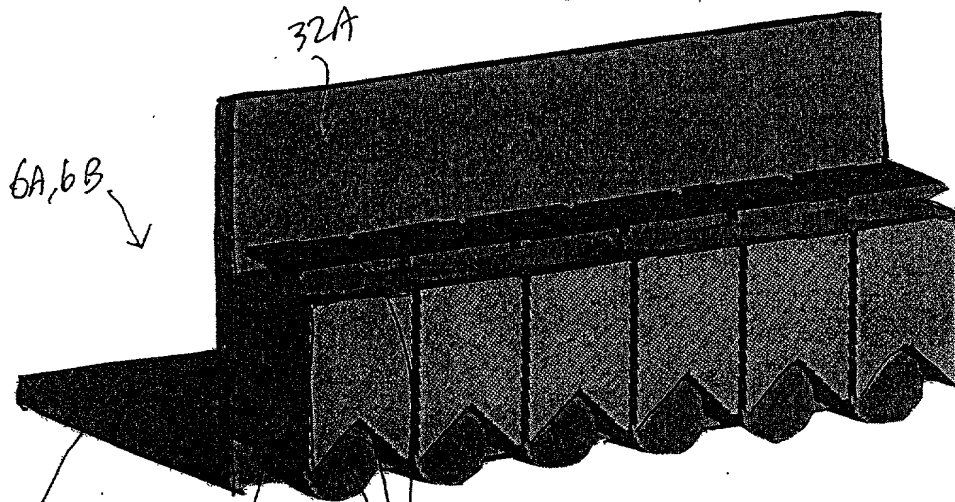
* Fixed Field Of Field

FIG. 1G5

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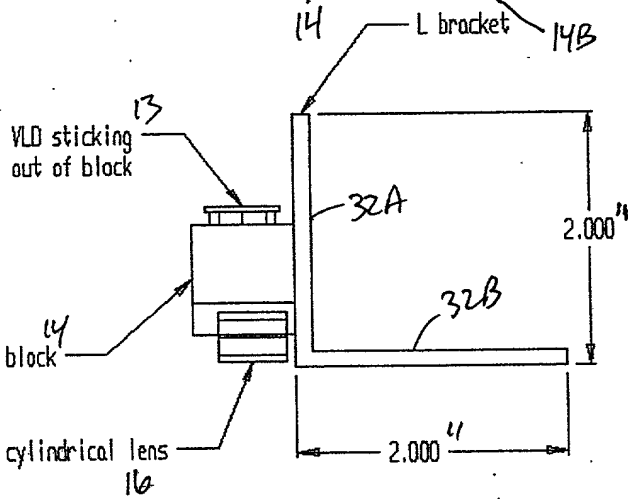
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32B

32A

FIG. 1G 8



VLD sticking out of block

14 block

cylindrical lens 16

FIG. 1G.9

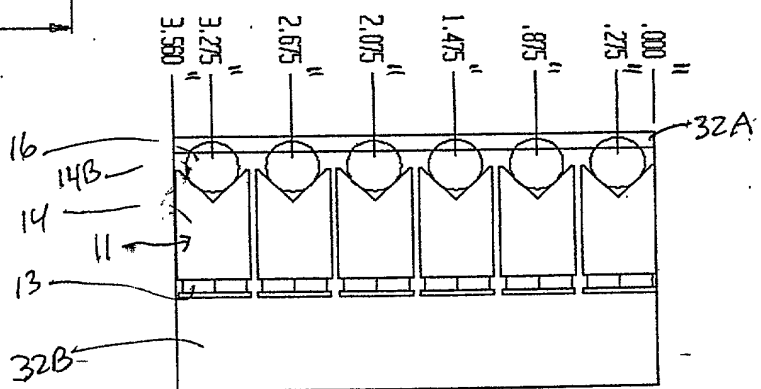


FIG. 1G10

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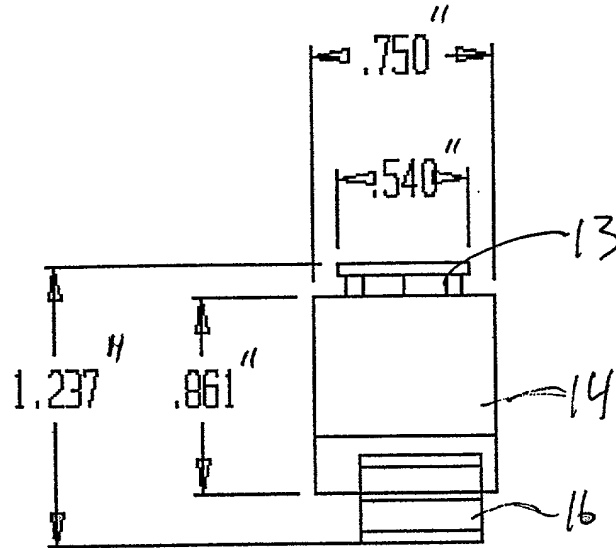


FIG. 1G11

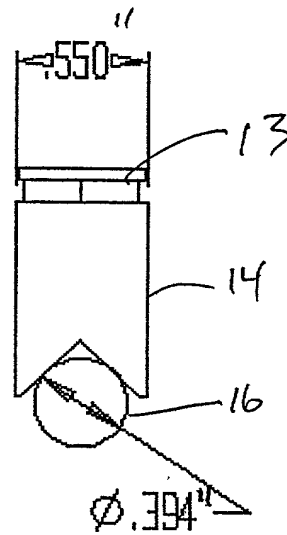


FIG. 1G12

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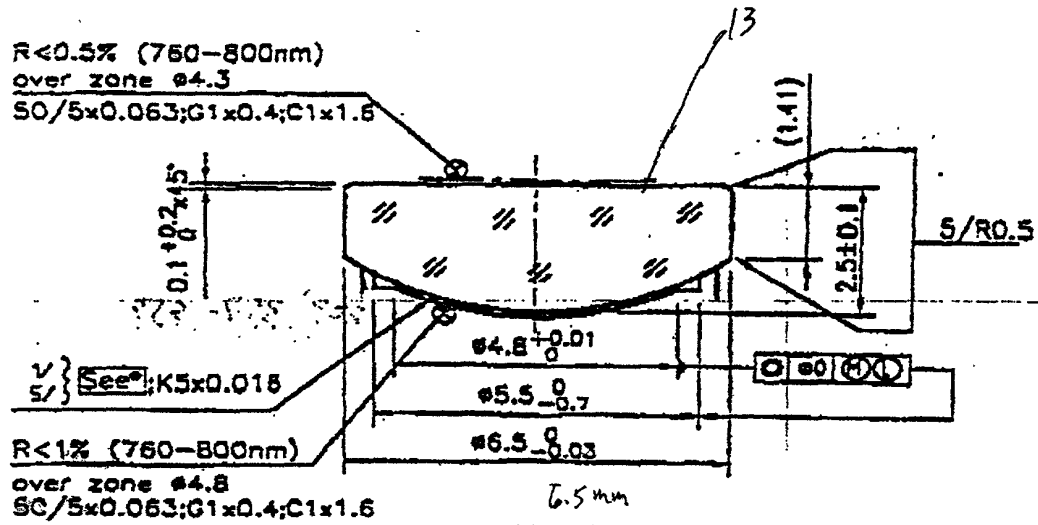


FIG. 1G13

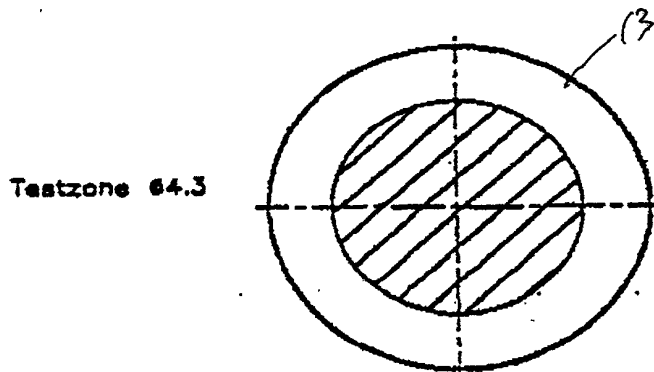


FIG. 1G14

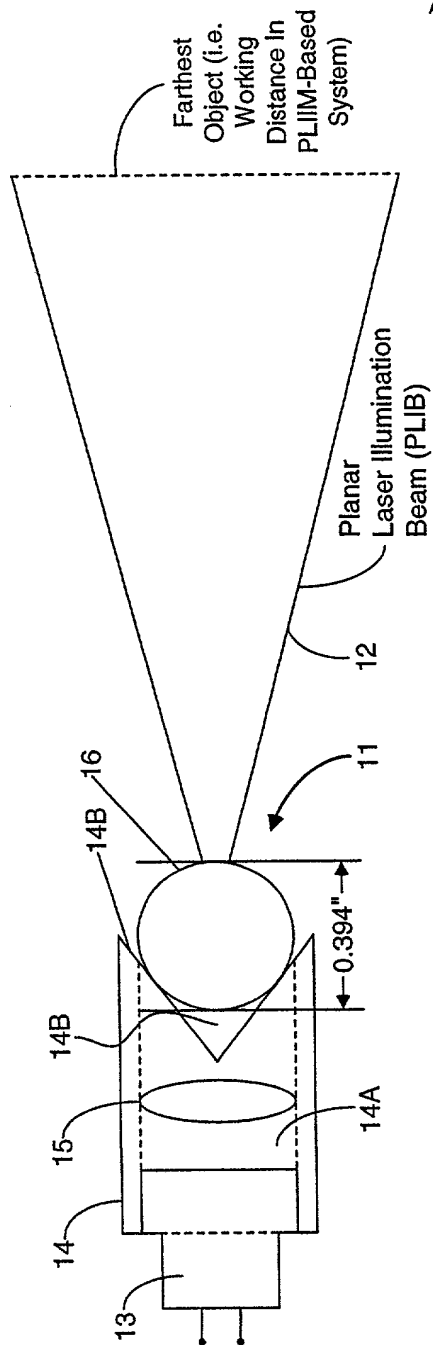


FIG. 1G15A

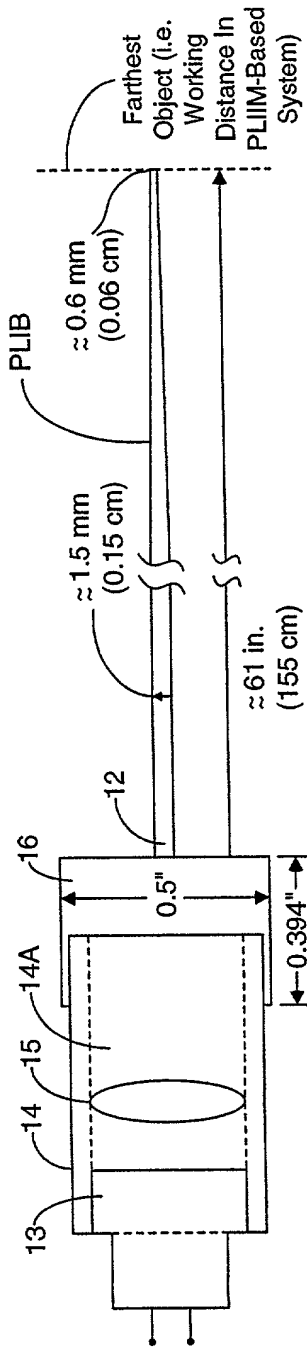
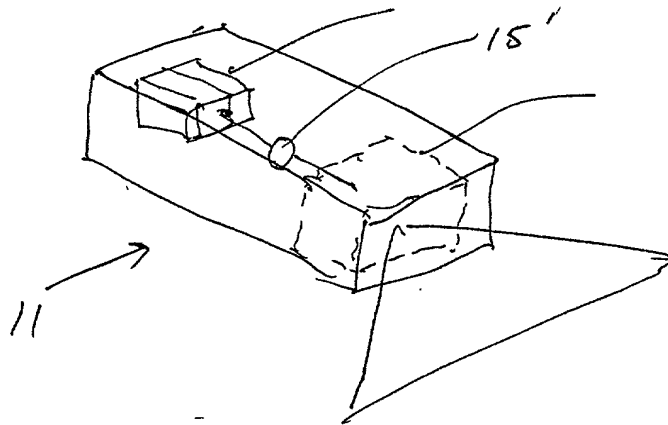
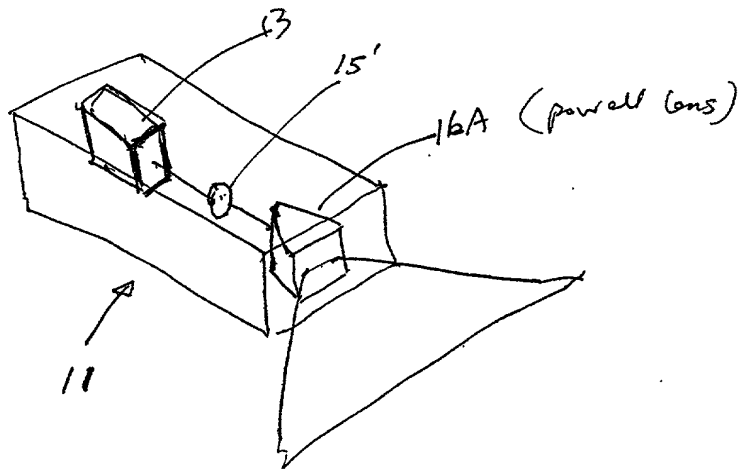


FIG. 1G15B

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• PLIM w/
powell lens

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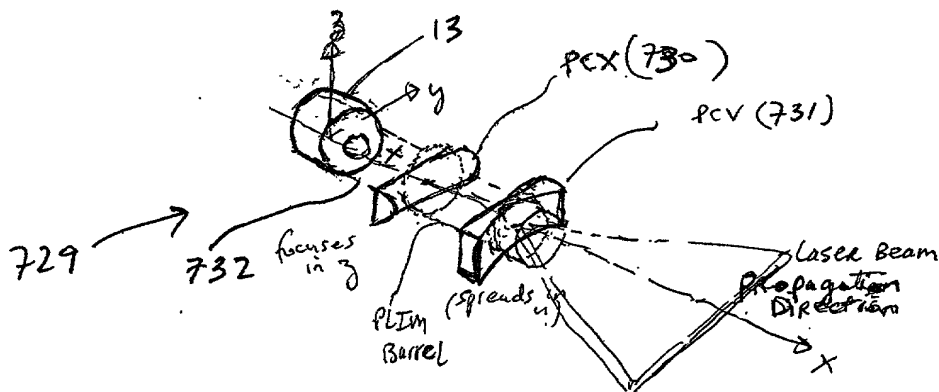


FIG. 16.17A

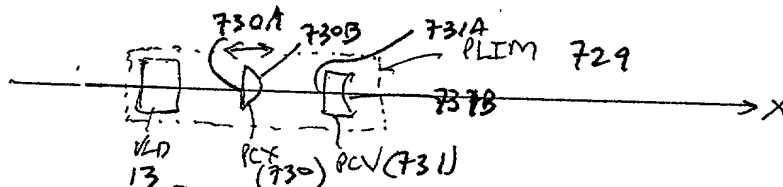


FIG. 16.17B

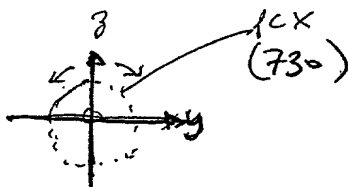


FIG. 16.17C

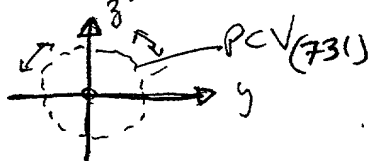


FIG. 16.17D



FIG. 16.17E

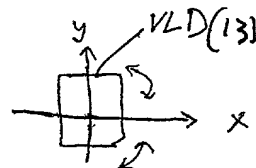
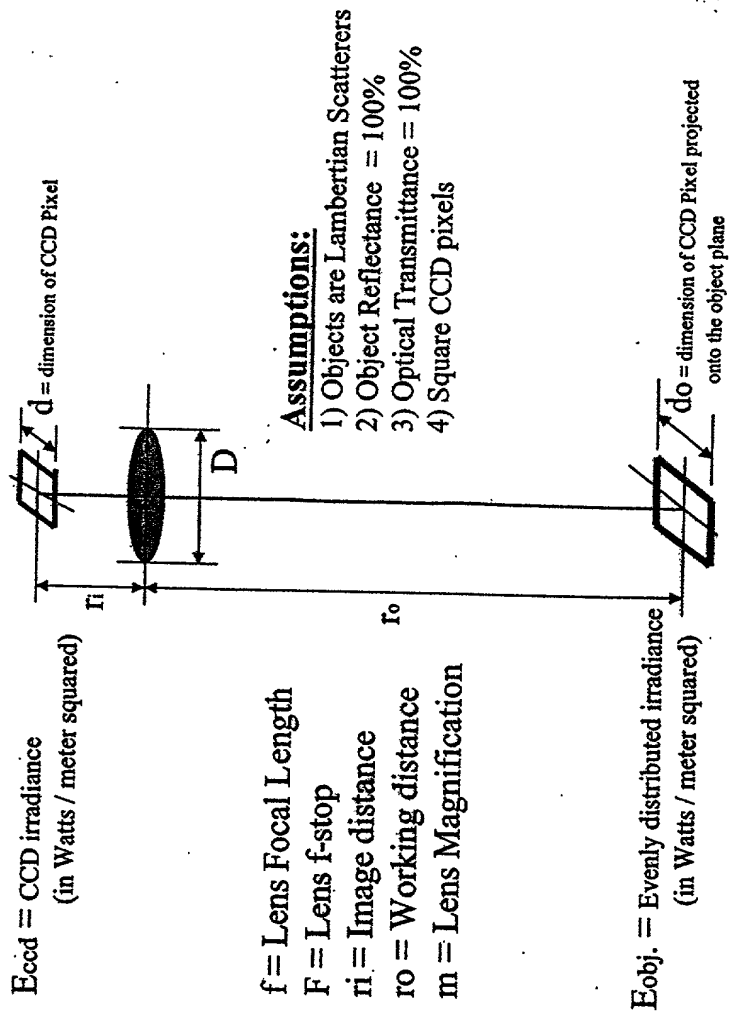


FIG. 16.17F

FOOTNOTES: 4444 66666666

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CCD-Based Scanner

FIG. 1H6

FIRST GENERALIZED METHOD
of Reducing Speckle-Noise
PATTERNS AT IMAGE
DETECTION array OF the
SPM system (3)

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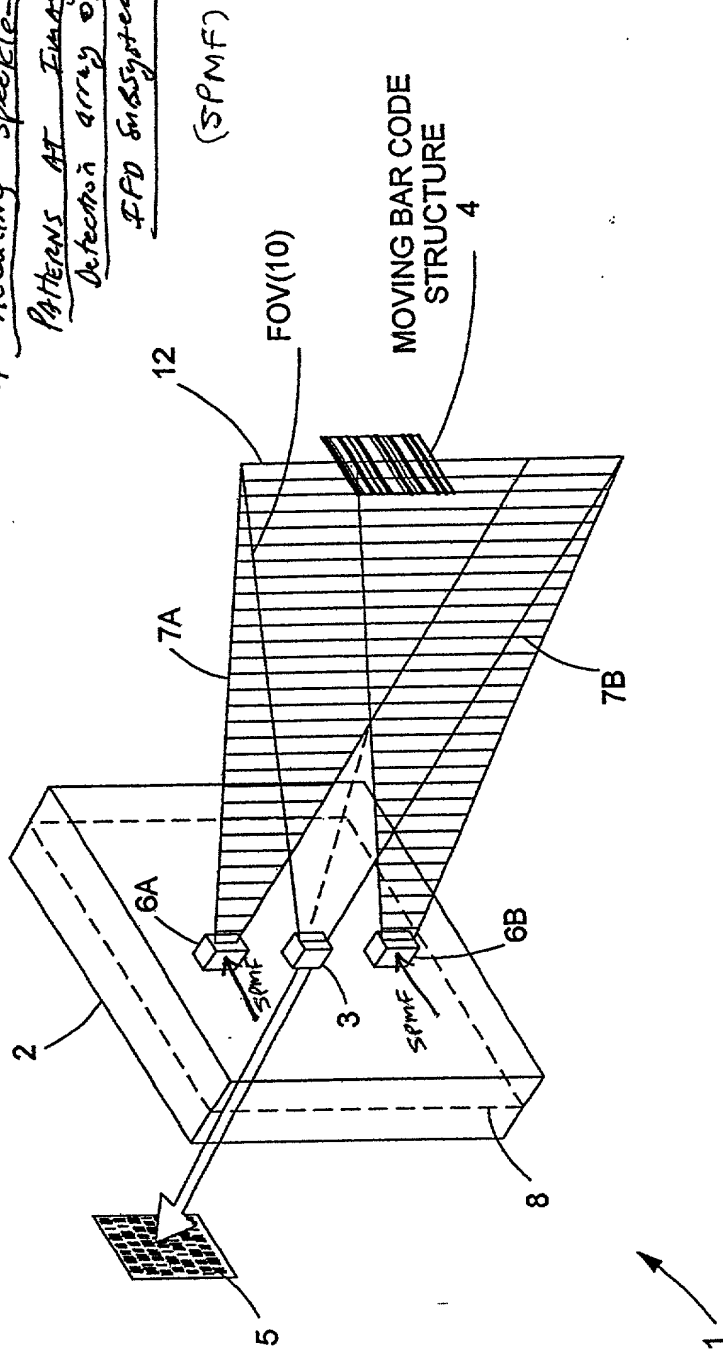


FIG. 1I1

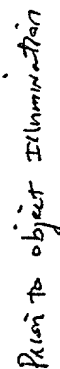


FIG. 1I 2A

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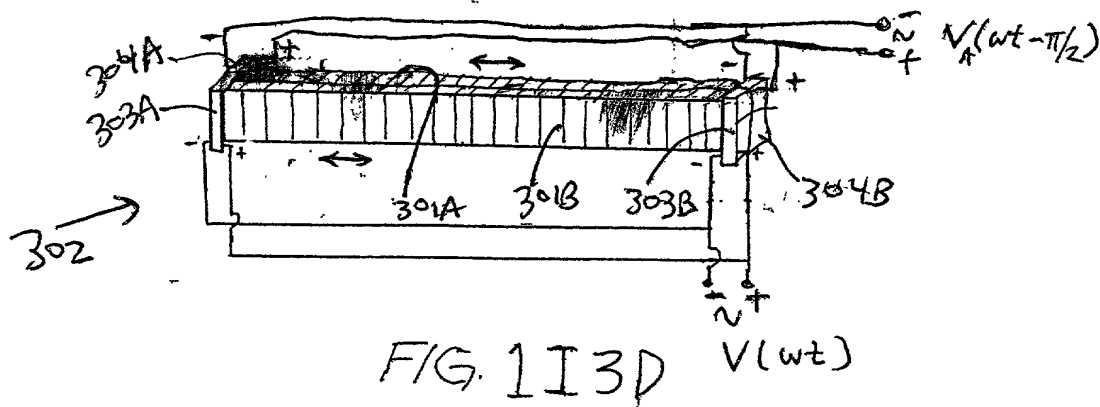
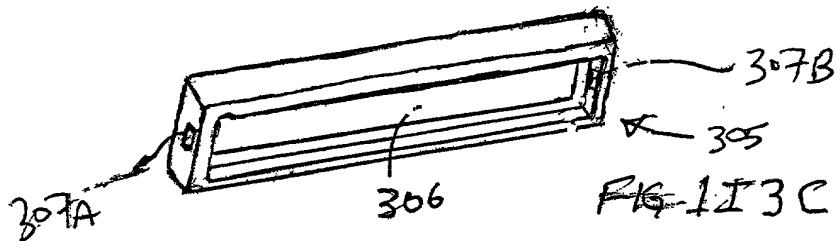
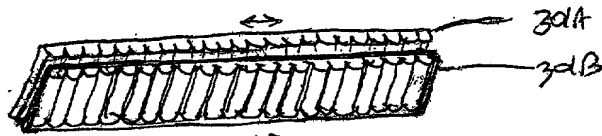
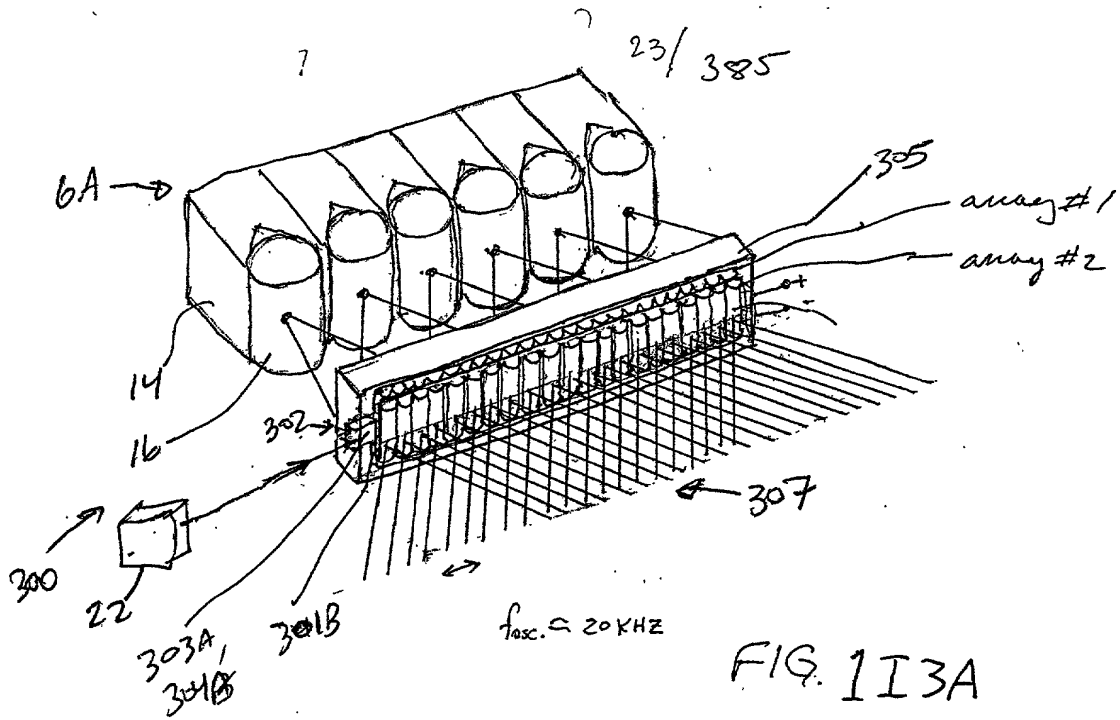
The First Generalized Speckle-Noise Pattern Reduction Method
Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial phase of the transmitted PLIB along the planar extent thereof according to a spatial phase modulation function (SPMF) so as to produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

↓

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the power of the speckle-noise pattern observed at the image detection array.

FIG. 1I2B



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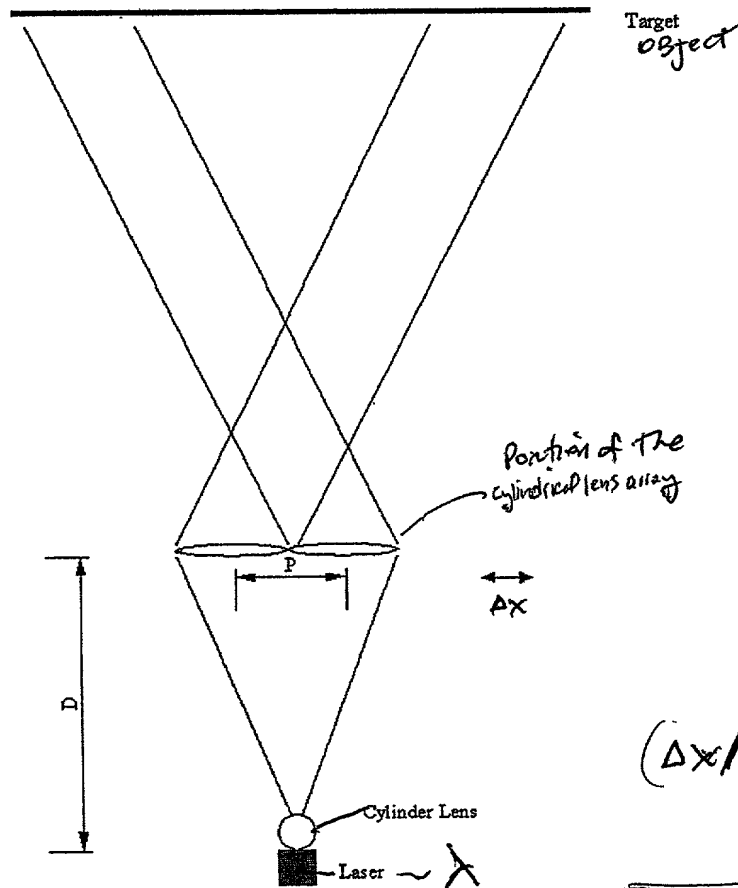


Figure 1

$$(\Delta x / D) P = \lambda$$

$$\Delta x \geq \frac{\lambda \cdot D}{P}$$

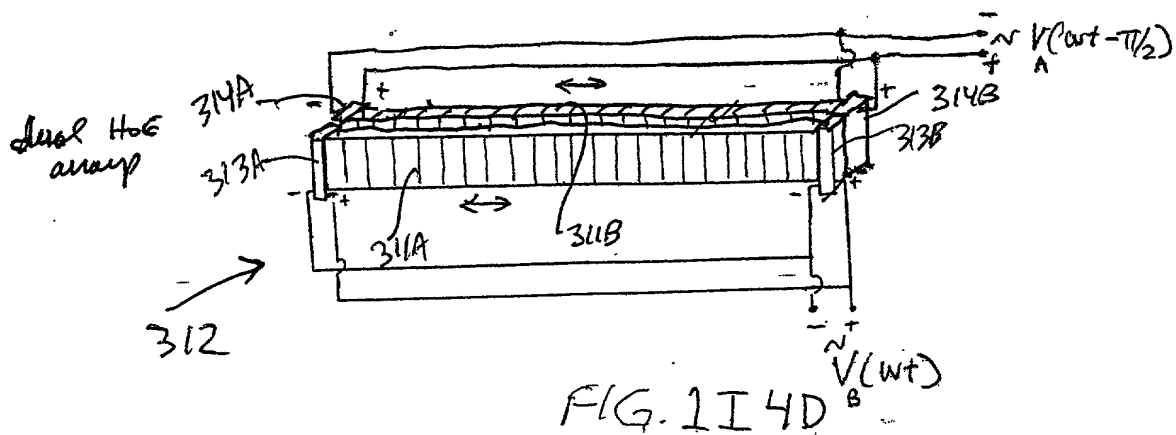
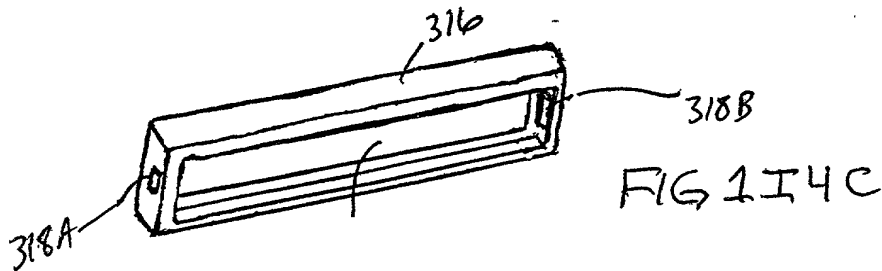
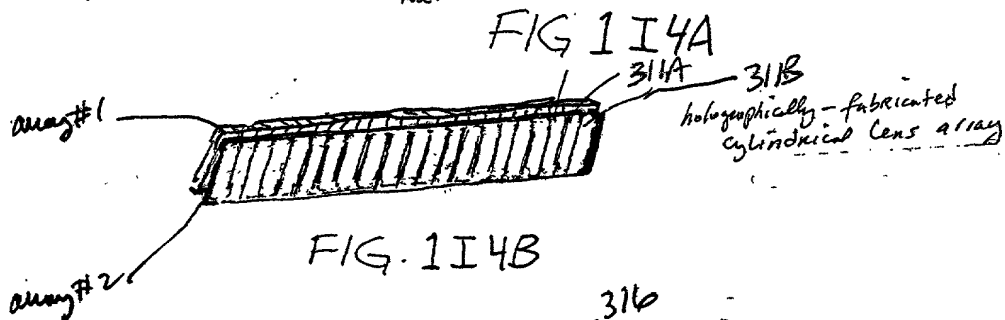
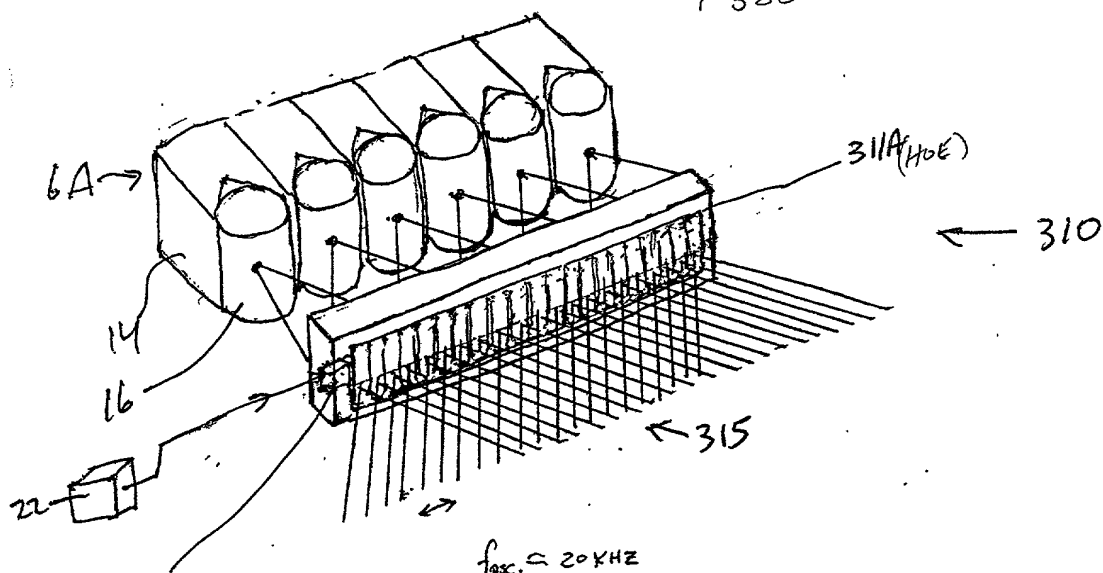
FIG. 1I3E

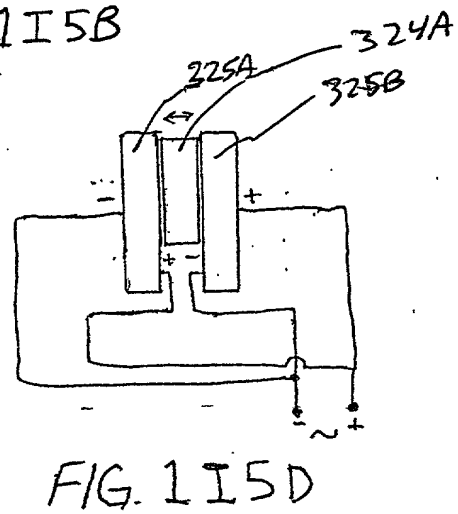
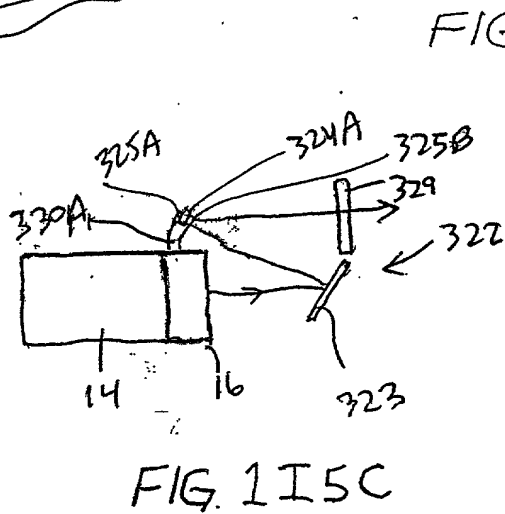
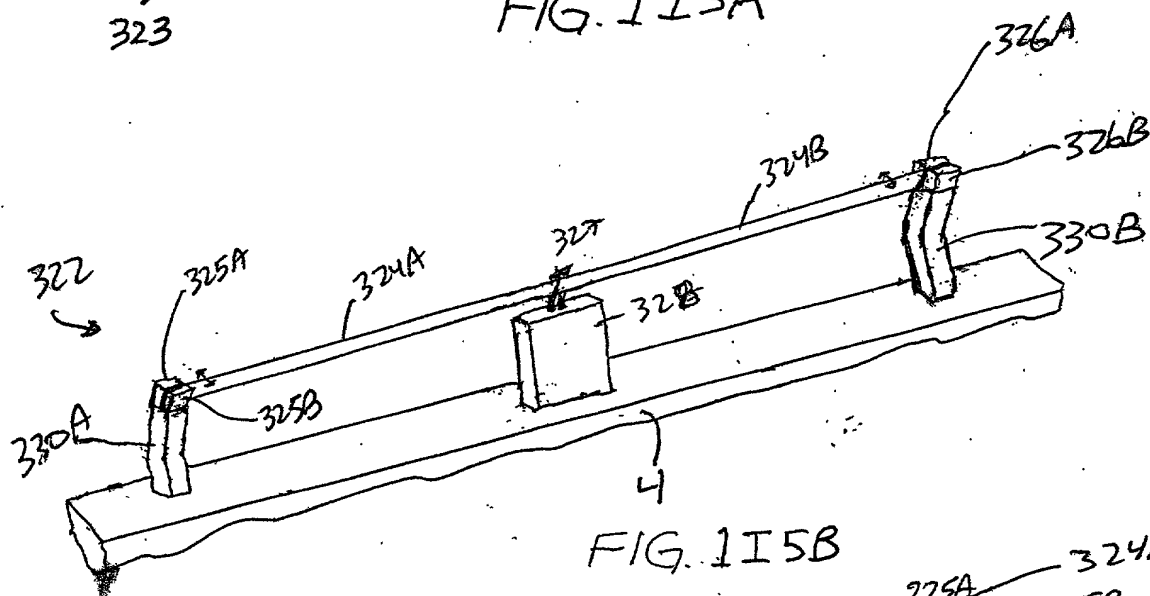
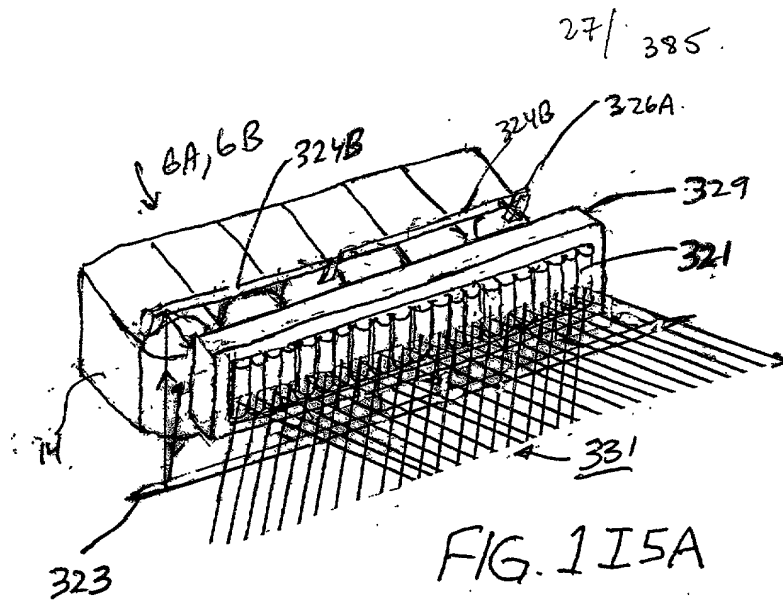
[illegible]

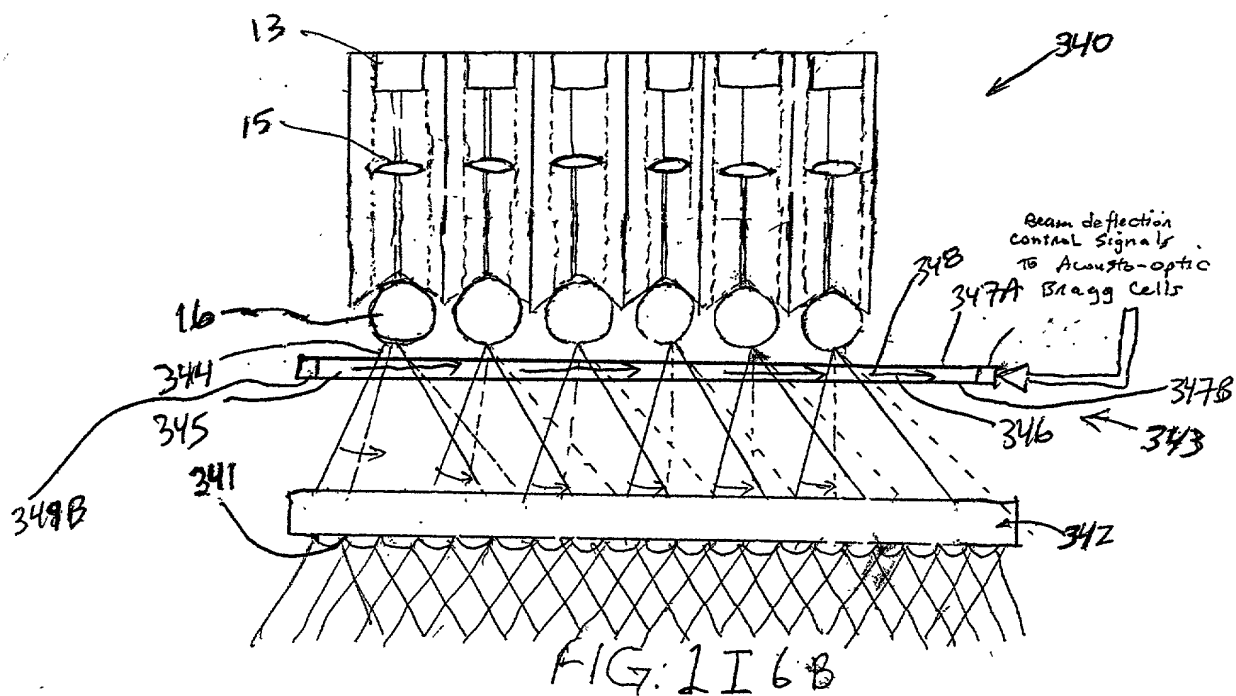
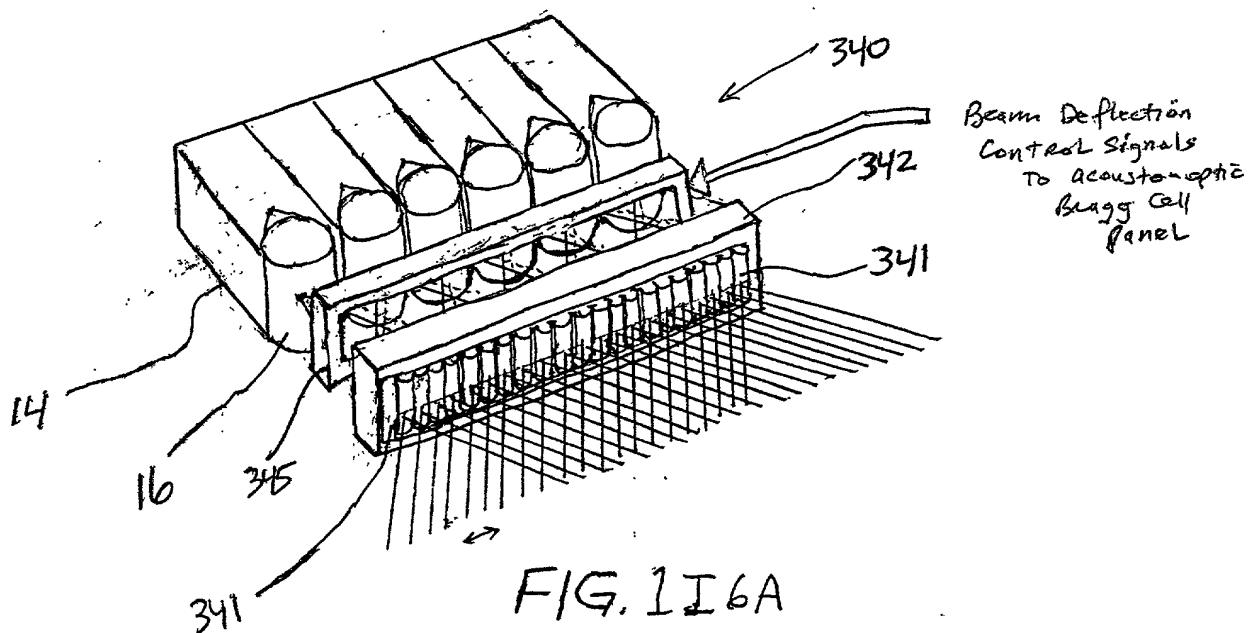
FIG 1I3G

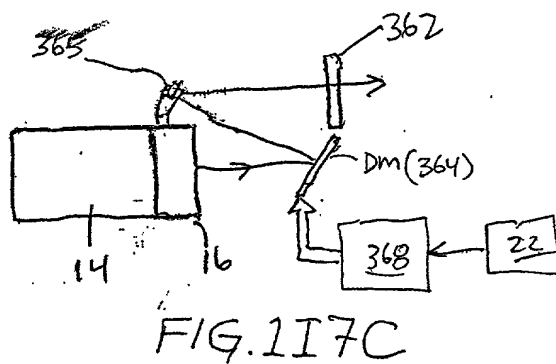
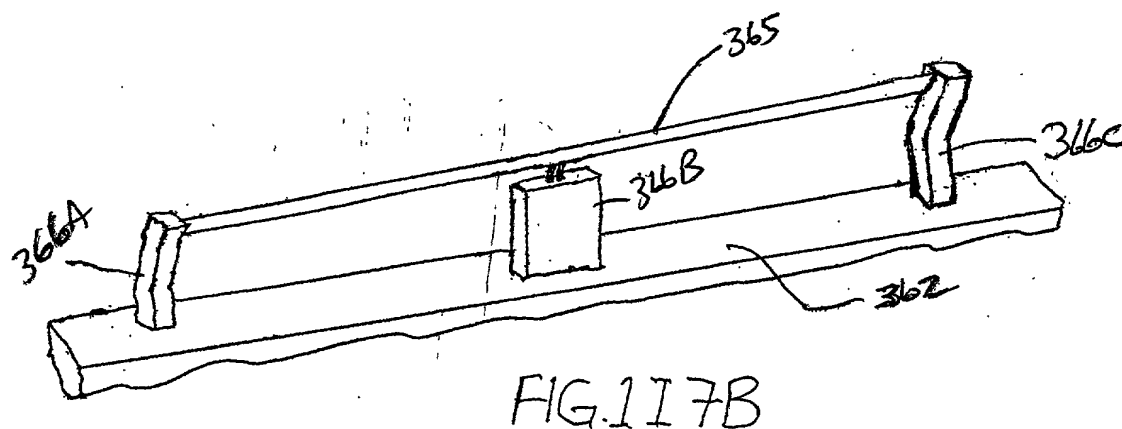
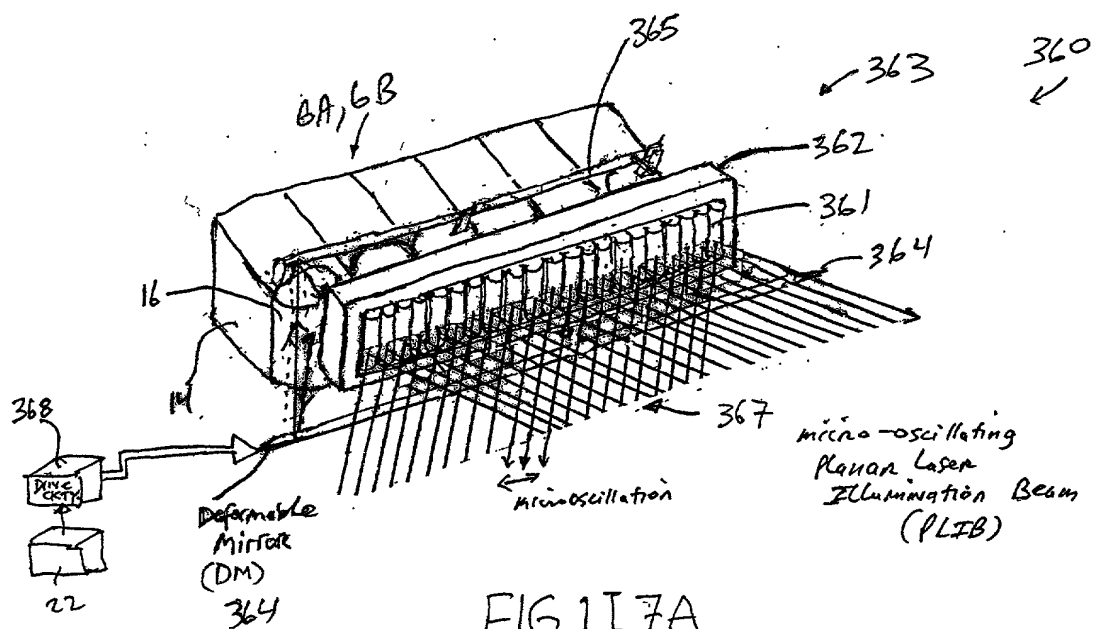


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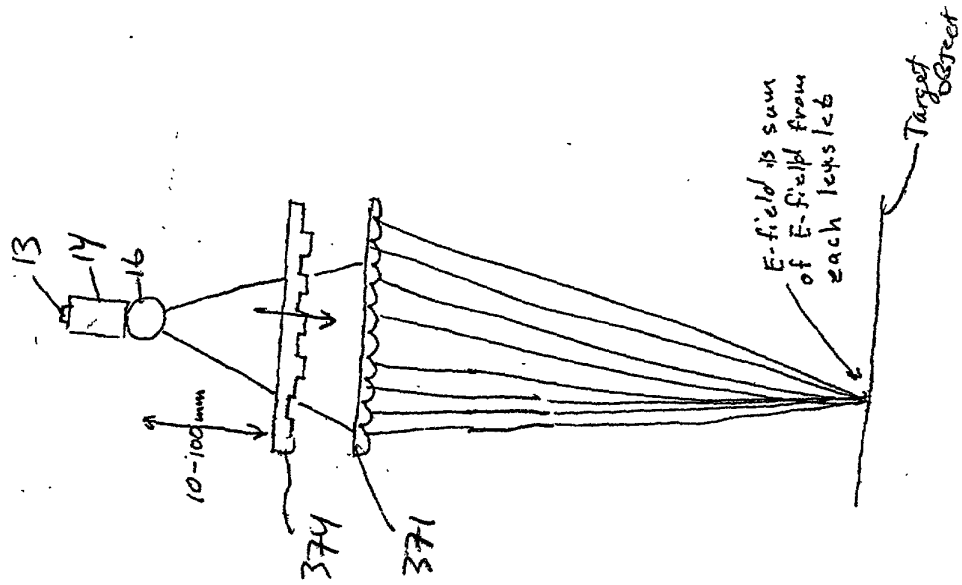


FIG 1I8E

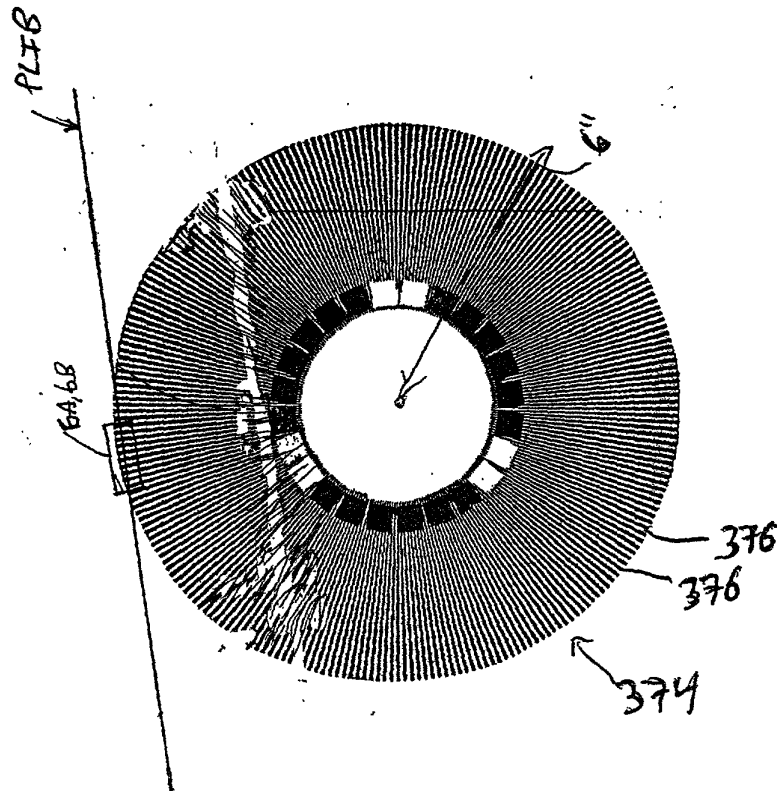


FIG 1I8D

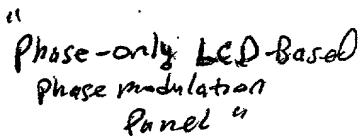
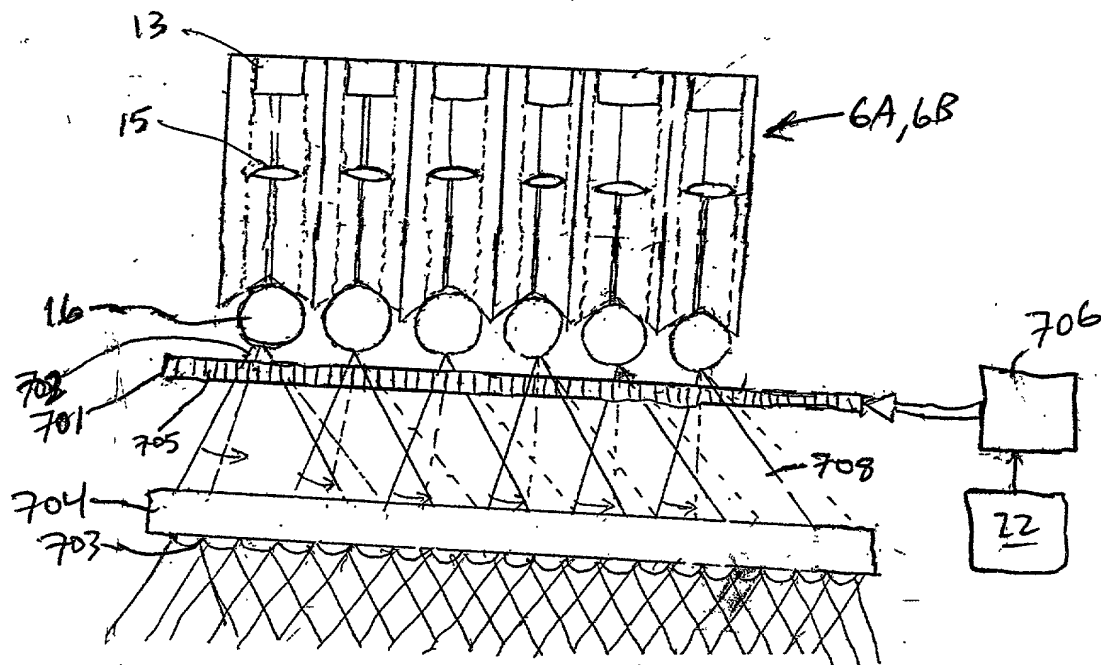


FIG. 1 I 8 G



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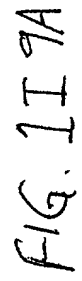
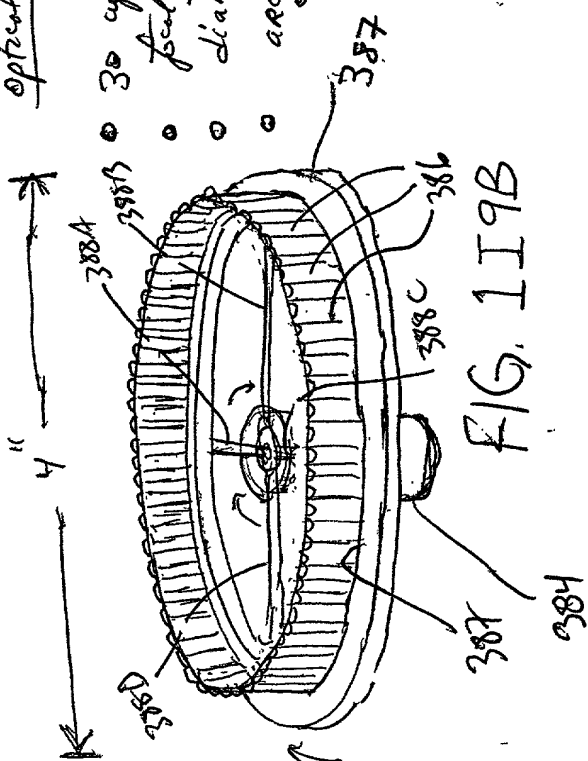


FIG. 1I 9A

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Optical specifications:

- 30 cylindrical lens (lenses) per linear inch
- focal length \approx 2.0 millimeters
- diameter of lenslet carousel \approx 4 inches
- acrylic material



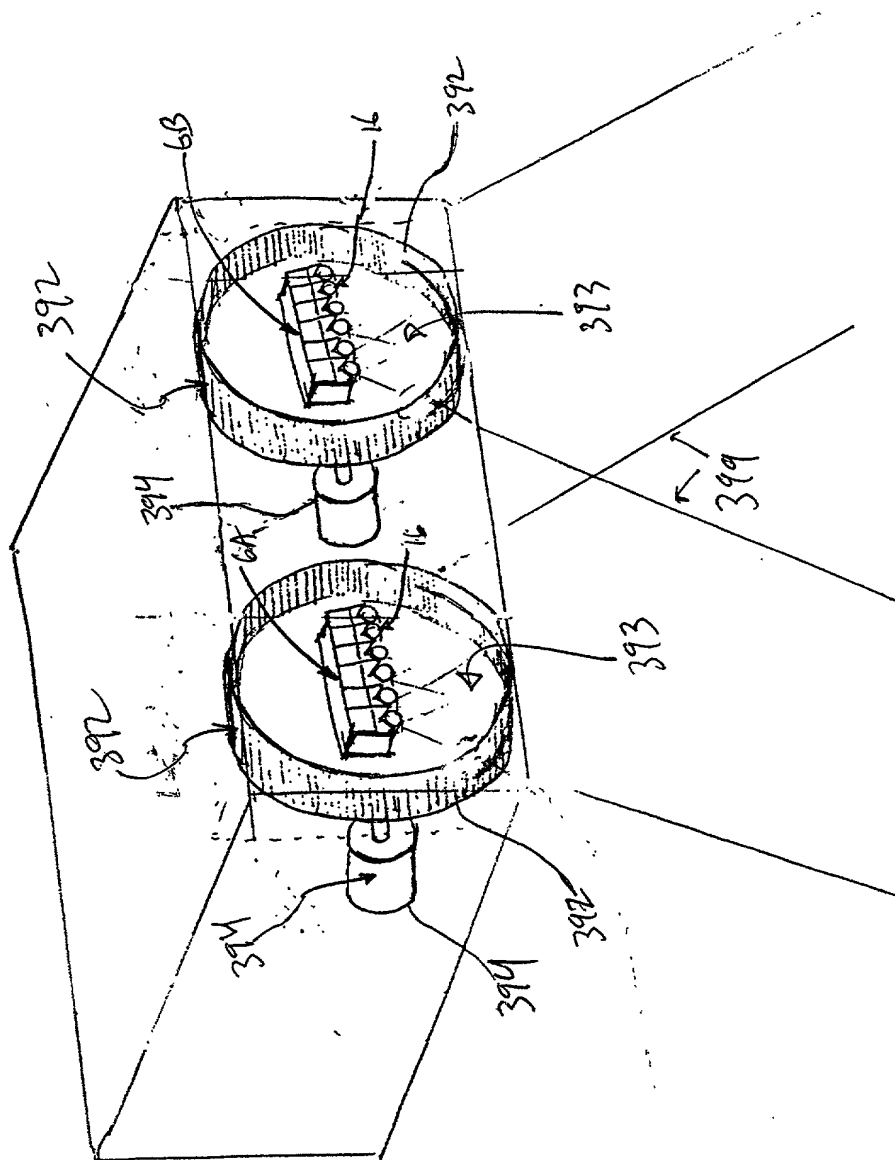
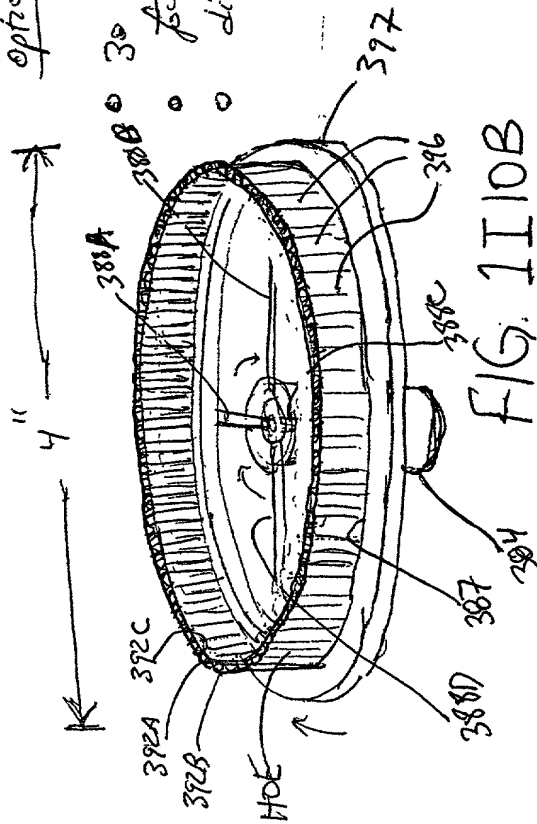


FIG. 1I 10A

Optical Specifications:

- 30 upturned lens (lines) per linear inch
- total length = 2.0 millimeters
- diameter of Centulus Carousel ≈ 4 inches



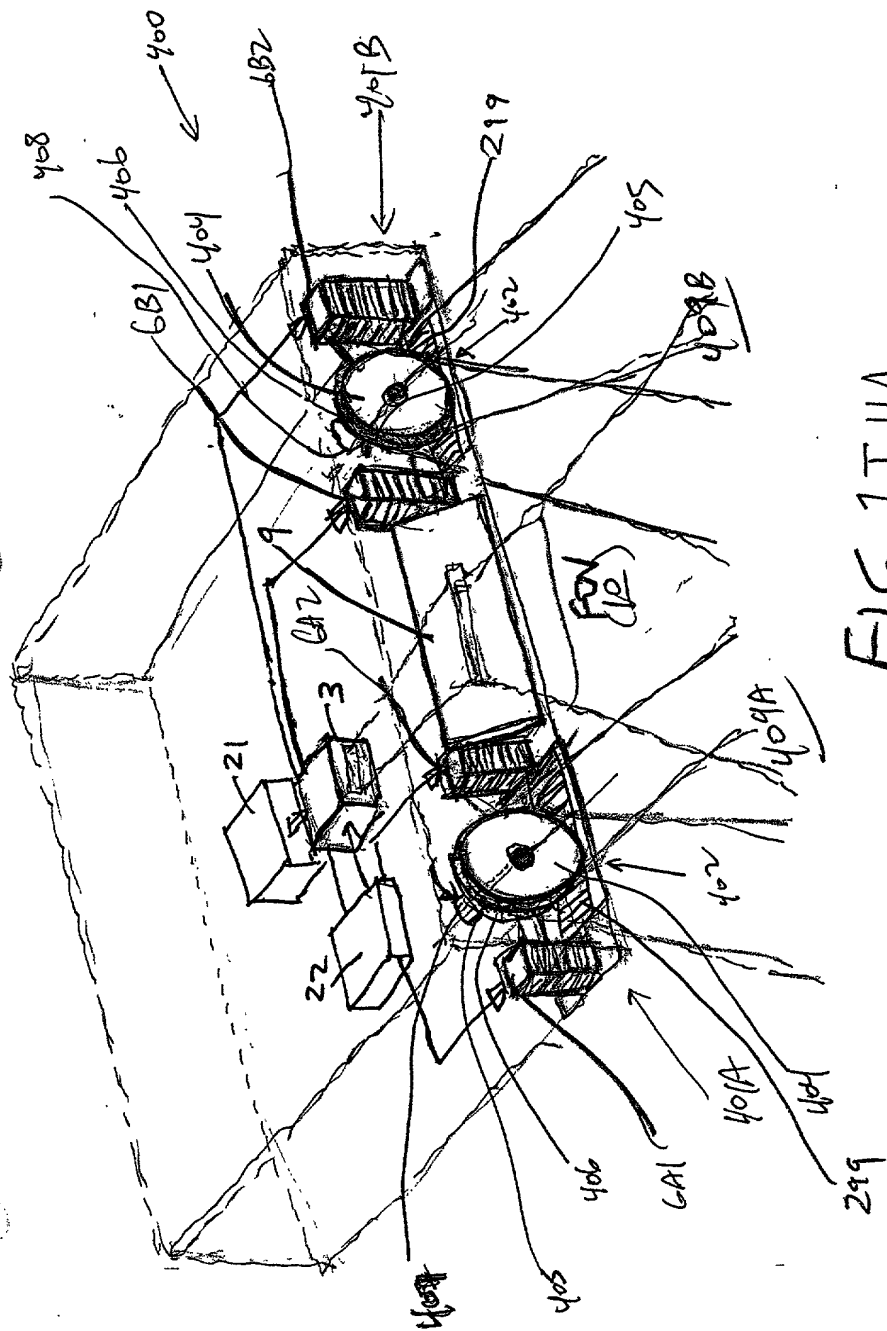
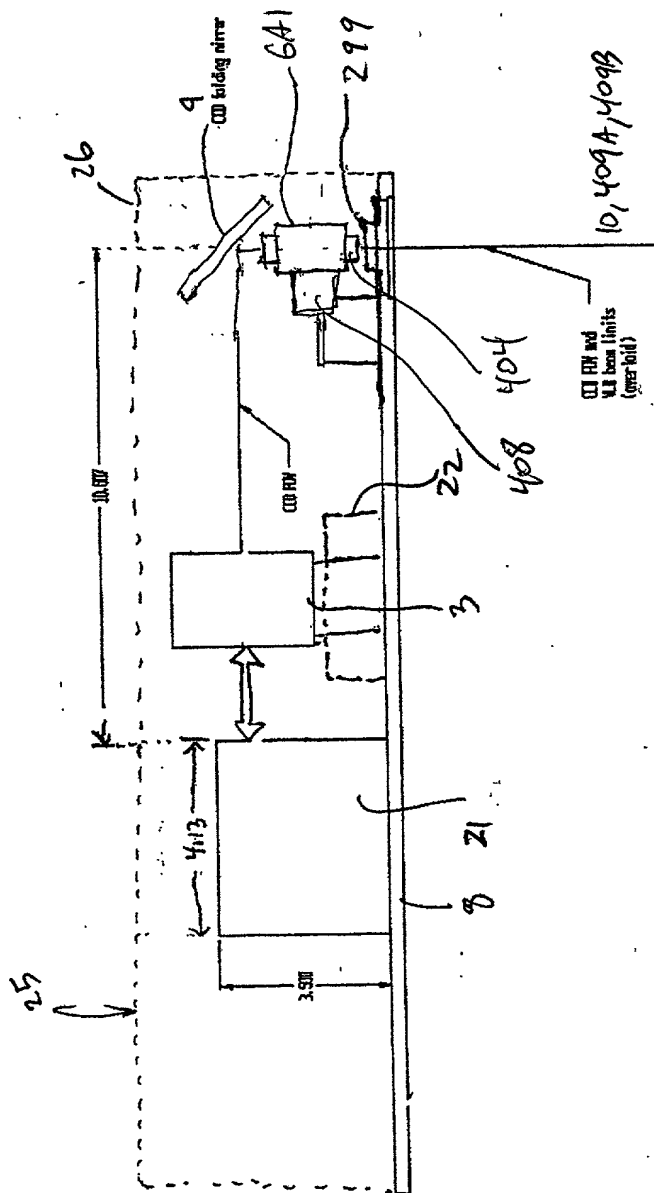
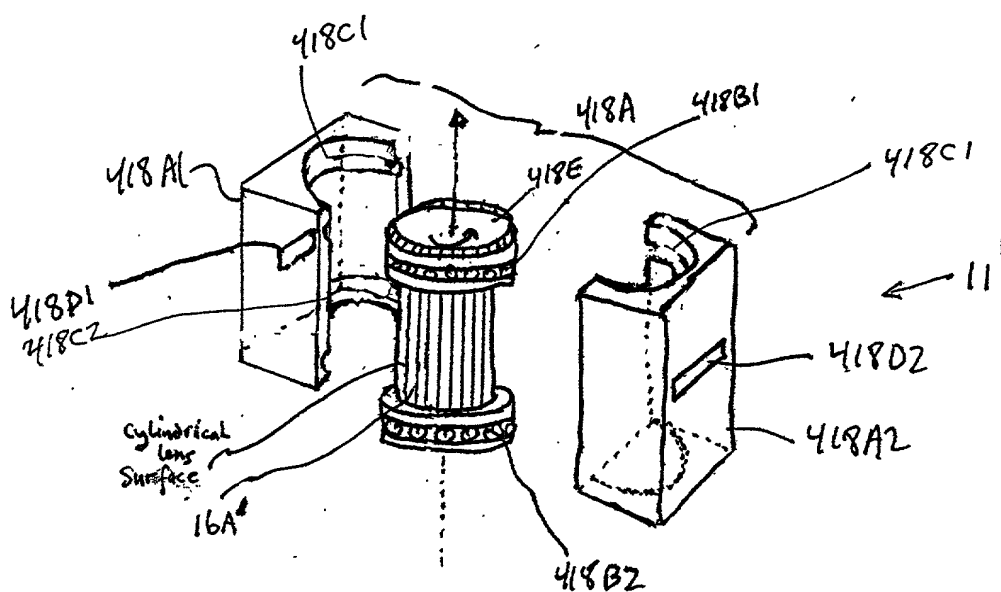
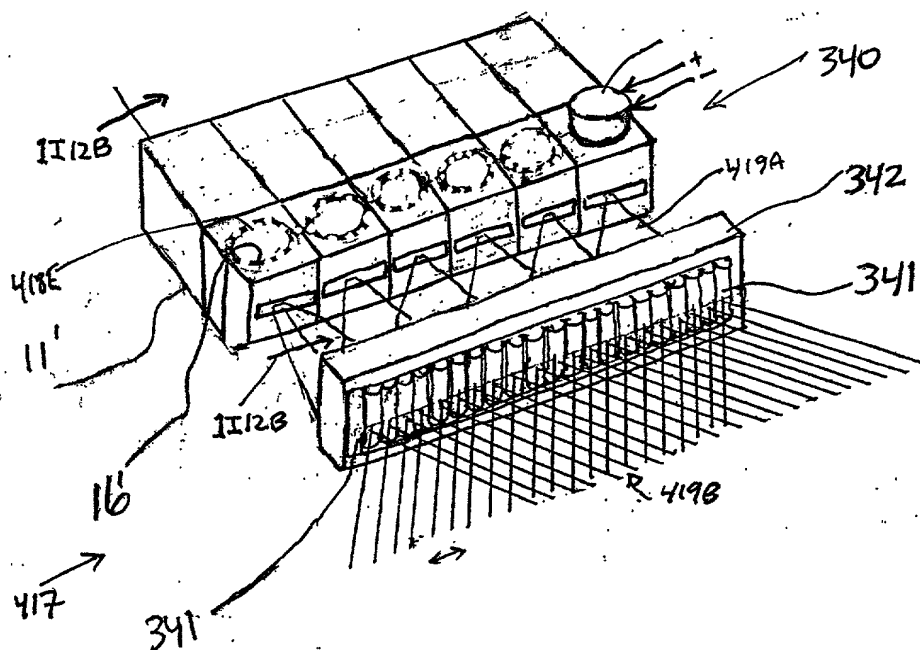


FIG. 1I IIA

[illegible]



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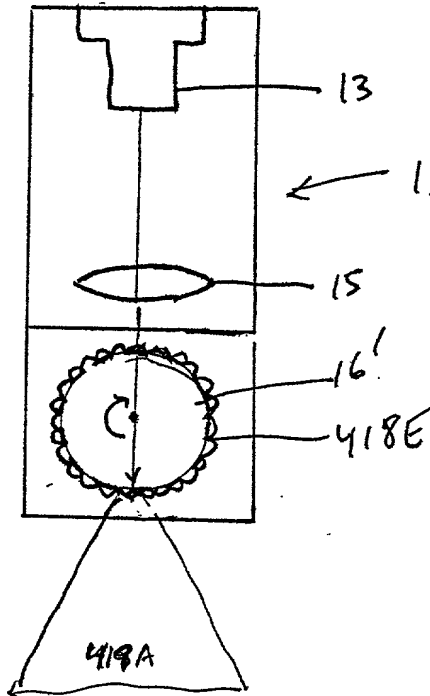


FIG. 1I12C

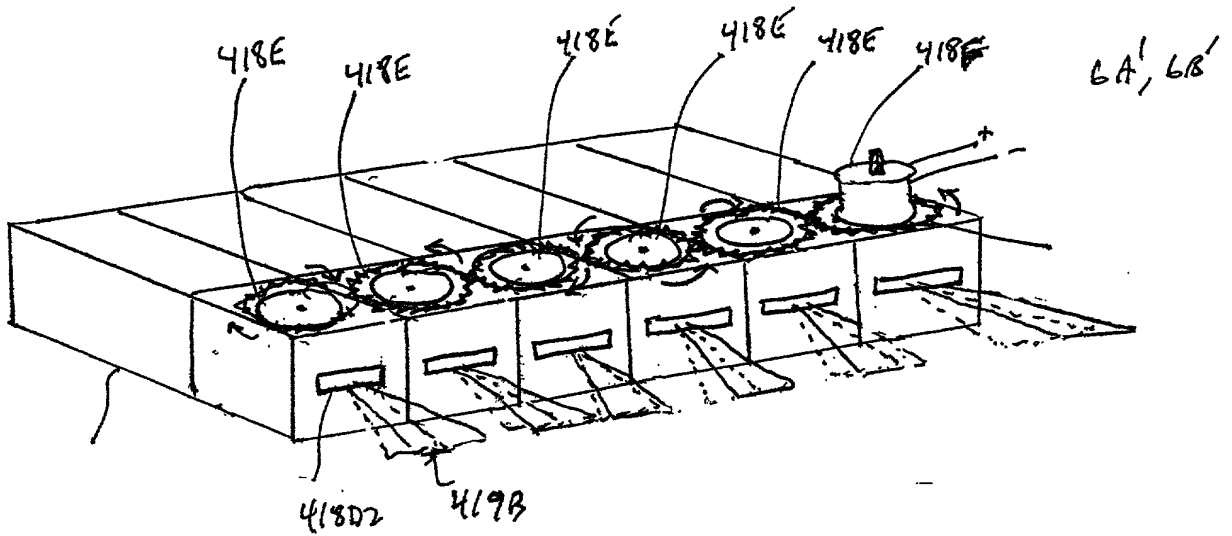


FIG. 1I12D

Second Generalized Method of

Reducing Speckle-Noise Patterns

of Image Detection Array

of the FFD Subsystem (3)

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(Fut)

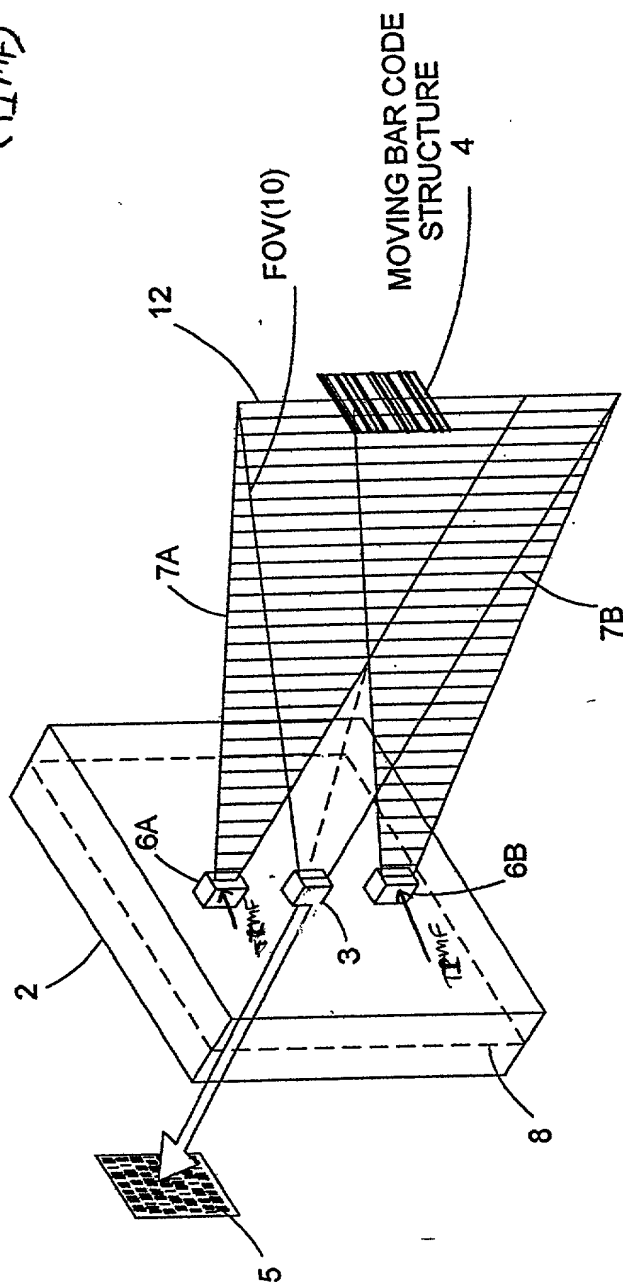


FIG. 1113

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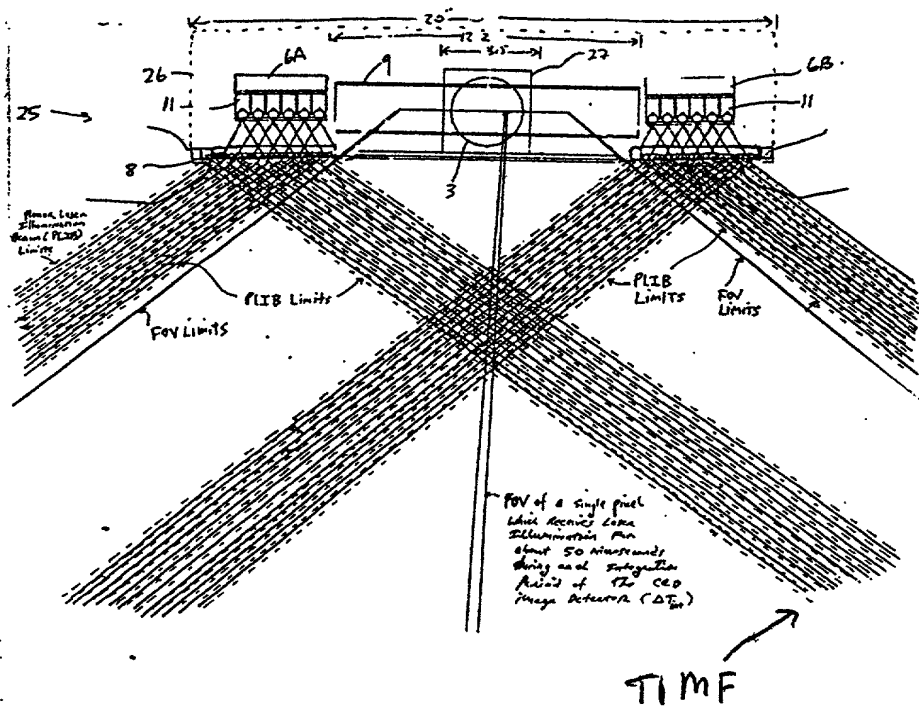


FIG. 1 I 13A

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The Second Generalized Speckle-Noise Pattern Reduction Method
Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal intensity of the transmitted PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMEF) so as to

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

↓

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce power of the speckle-noise pattern observed at the image detection array.

FIG. 1I13B

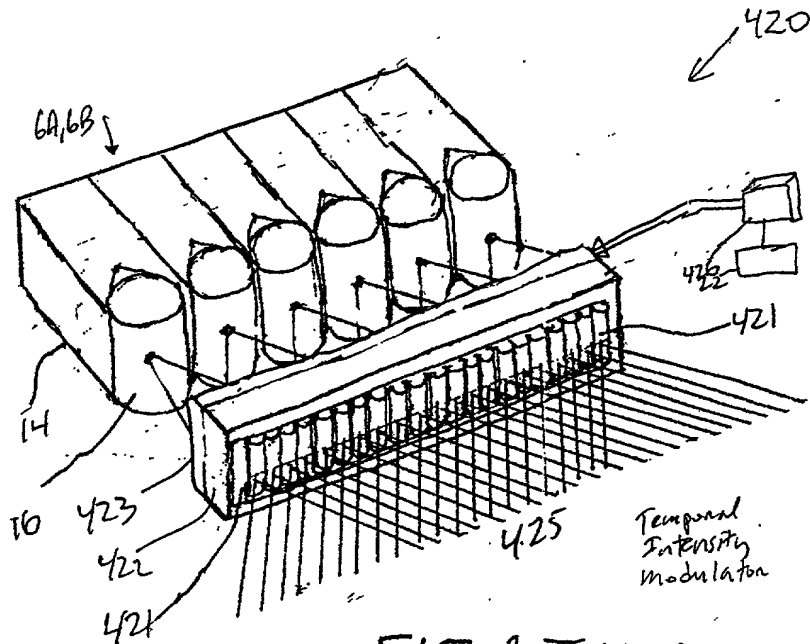


FIG. 1I14A

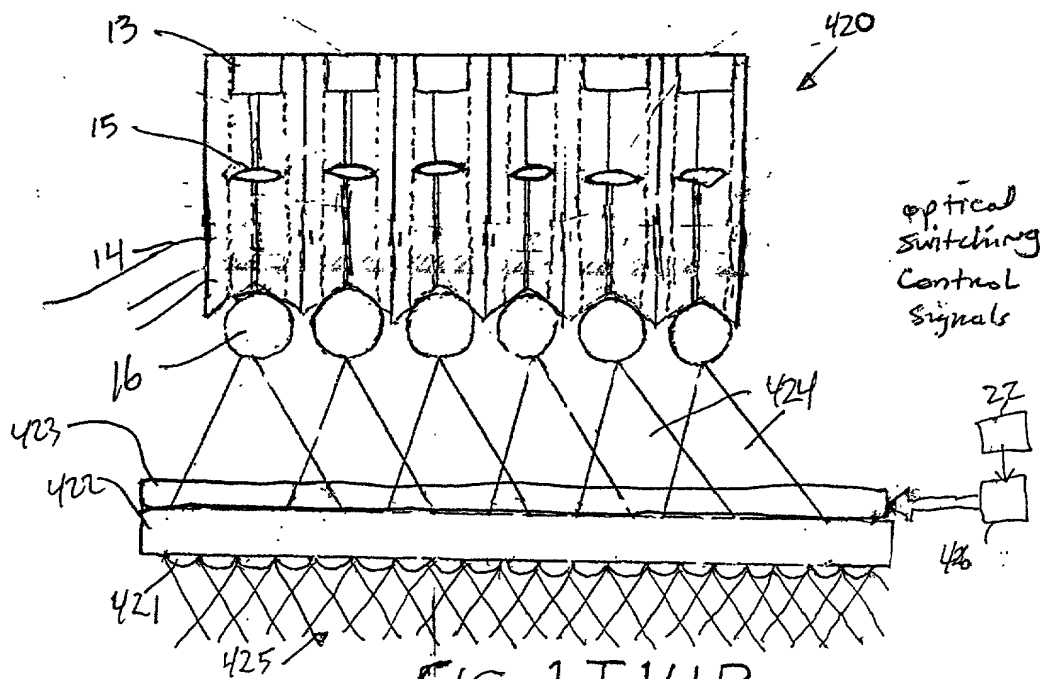


FIG. 1I14B

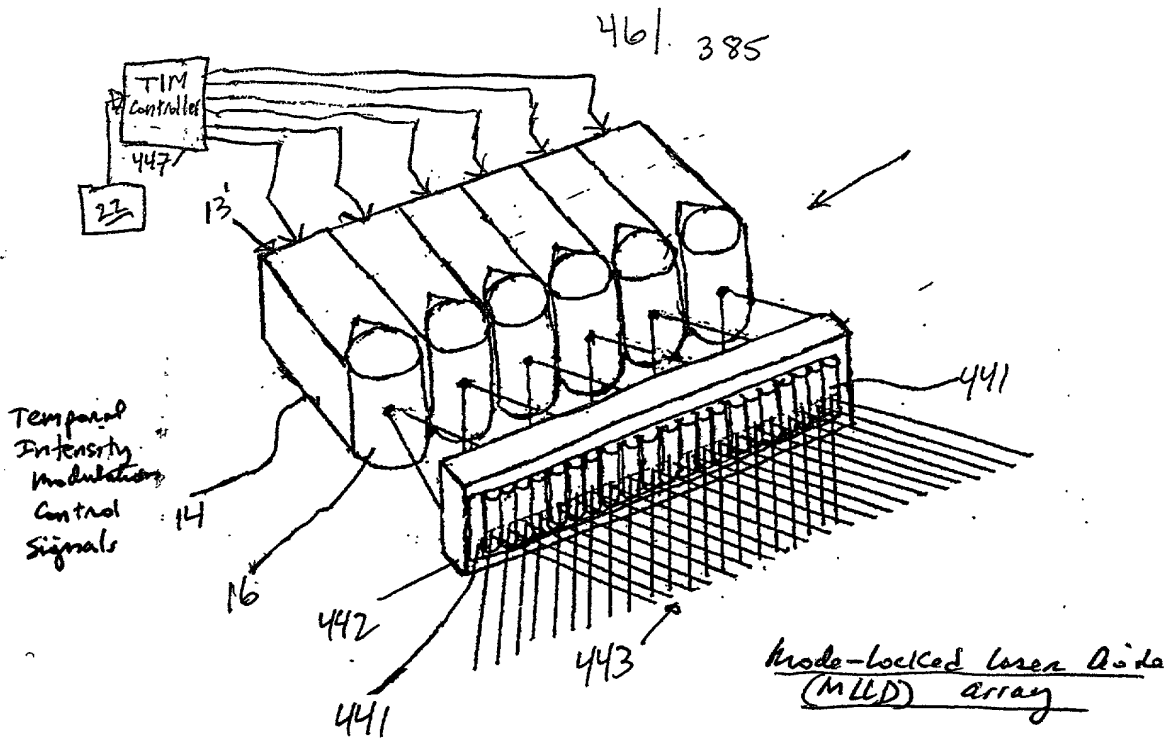


FIG. 1I15A

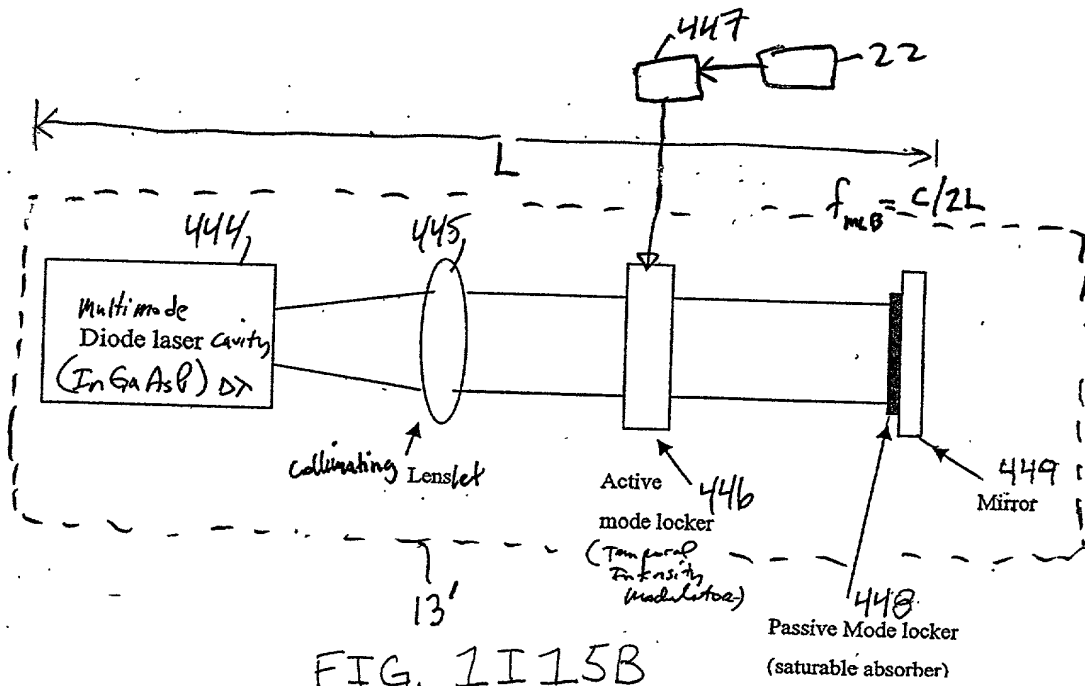


FIG. 1I15B

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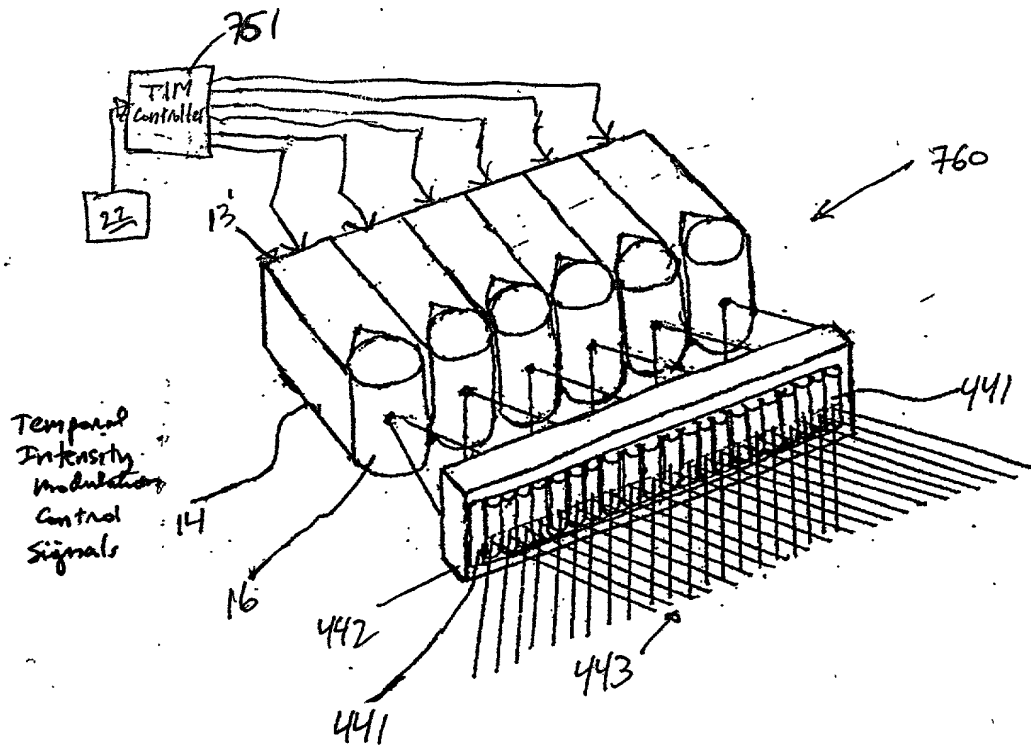


FIG. 1I15C

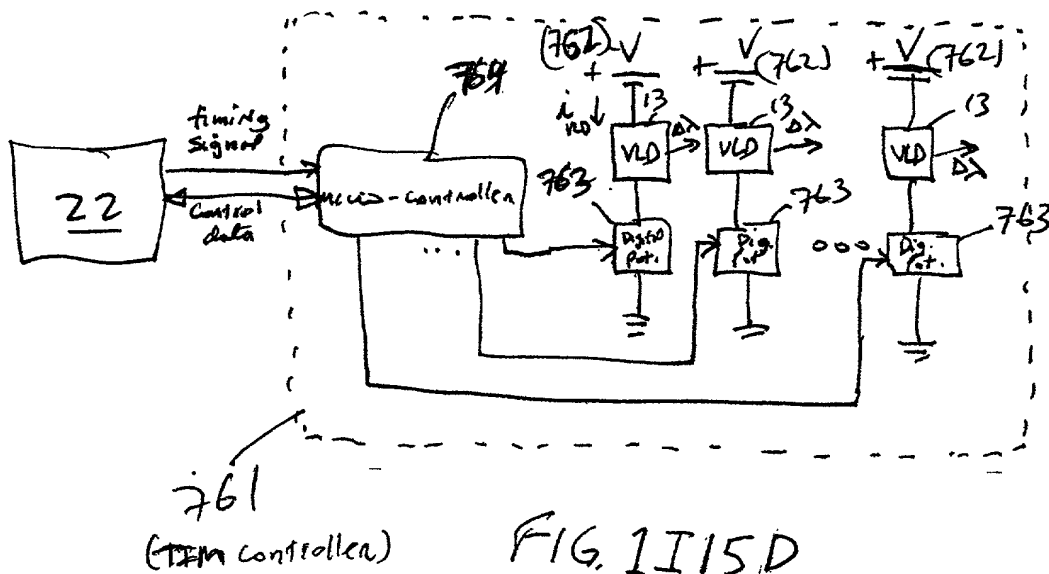
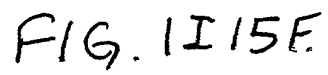
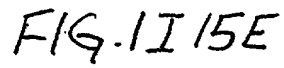


FIG. 1I15D

Variable	Mean	Standard Deviation	Minimum	Maximum
Age	35.5	10.5	20	55
Gender	0.5	0.5	0	1
Marital Status	0.5	0.5	0	1
Education	12.5	1.5	10	15
Income	3000	1000	1000	5000
Health	0.5	0.5	0	1
Smoking	0.2	0.4	0	1
Alcohol	0.1	0.3	0	1
Exercise	0.3	0.5	0	1
Stress	0.4	0.5	0	1
Sleep	0.5	0.5	0	1
Diet	0.5	0.5	0	1
Work	0.5	0.5	0	1
Family	0.5	0.5	0	1
Friends	0.5	0.5	0	1
Hobbies	0.5	0.5	0	1
Travel	0.5	0.5	0	1
Shopping	0.5	0.5	0	1
Reading	0.5	0.5	0	1
TV	0.5	0.5	0	1
Music	0.5	0.5	0	1
Gardening	0.5	0.5	0	1
Cooking	0.5	0.5	0	1
Cleaning	0.5	0.5	0	1
Driving	0.5	0.5	0	1
Walking	0.5	0.5	0	1
Swimming	0.5	0.5	0	1
Fishing	0.5	0.5	0	1
Hunting	0.5	0.5	0	1
Volunteering	0.5	0.5	0	1
Religion	0.5	0.5	0	1
Politics	0.5	0.5	0	1
Philosophy	0.5	0.5	0	1
Art	0.5	0.5	0	1
Science	0.5	0.5	0	1
History	0.5	0.5	0	1
Geography	0.5	0.5	0	1
Language	0.5	0.5	0	1
Math	0.5	0.5	0	1
Logic	0.5	0.5	0	1
Reasoning	0.5	0.5	0	1
Memory	0.5	0.5	0	1
Attention	0.5	0.5	0	1
Concentration	0.5	0.5	0	1
Perception	0.5	0.5	0	1
Emotion	0.5	0.5	0	1
Mood	0.5	0.5	0	1
Personality	0.5	0.5	0	1
Character	0.5	0.5	0	1
Values	0.5	0.5	0	1
Beliefs	0.5	0.5	0	1
Attitudes	0.5	0.5	0	1
Opinions	0.5	0.5	0	1
Preferences	0.5	0.5	0	1
Interests	0.5	0.5	0	1
Skills	0.5	0.5	0	1
Talents	0.5	0.5	0	1
Abilities	0.5	0.5	0	1
Intelligence	0.5	0.5	0	1
Wisdom	0.5	0.5	0	1
Knowledge	0.5	0.5	0	1
Experience	0.5	0.5	0	1
Learning	0.5	0.5	0	1
Growth	0.5	0.5	0	1
Development	0.5	0.5	0	1
Progress	0.5	0.5	0	1
Success	0.5	0.5	0	1
Failure	0.5	0.5	0	1
Challenge	0.5	0.5	0	1
Obstacle	0.5	0.5	0	1
Problem	0.5	0.5	0	1
Solution	0.5	0.5	0	1
Answer	0.5	0.5	0	1
Question	0.5	0.5	0	1
Topic	0.5	0.5	0	1
Subject	0.5	0.5	0	1
Field	0.5	0.5	0	1
Area	0.5	0.5	0	1
Domain	0.5	0.5	0	1
Category	0.5	0.5	0	1
Class	0.5	0.5	0	1
Type	0.5	0.5	0	1
Form	0.5	0.5	0	1
Shape	0.5	0.5	0	1
Size	0.5	0.5	0	1
Weight	0.5	0.5	0	1
Height	0.5	0.5	0	1



Third Generalized Method of
Reducing Speckle-Noise Patterns
at Image Detection Array
of the FFD Subsystem (3)

(TIME)

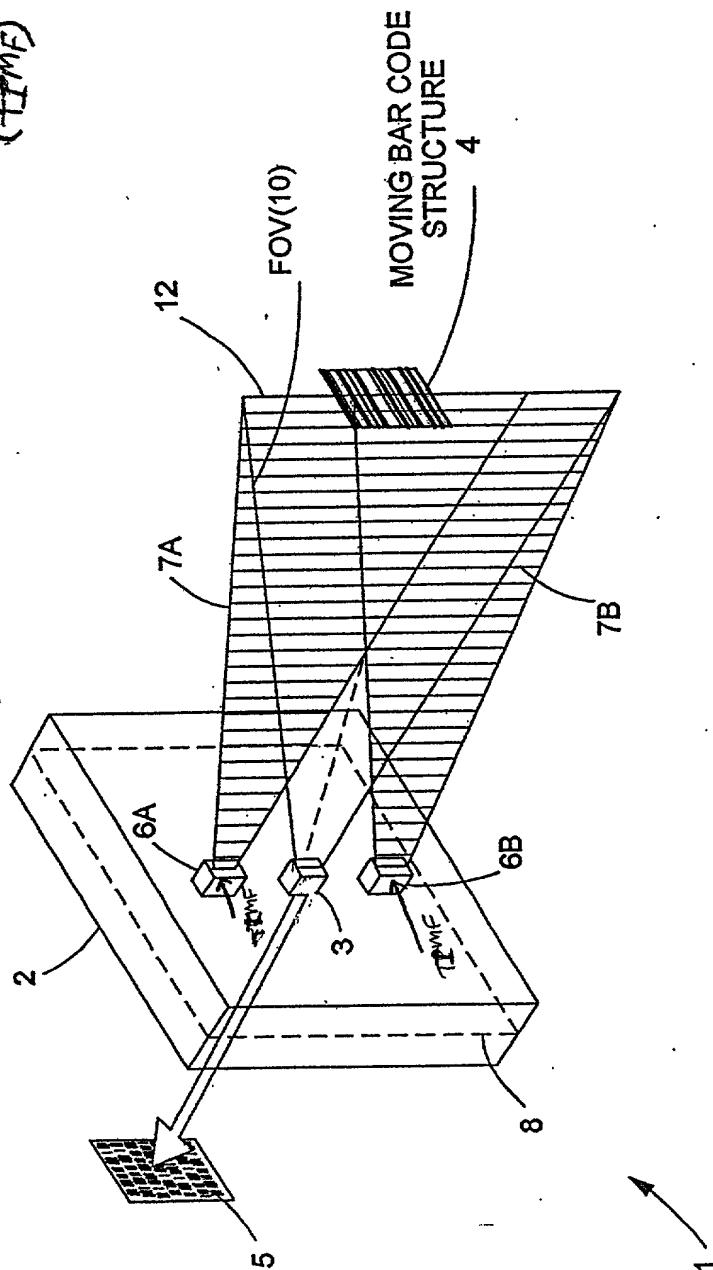
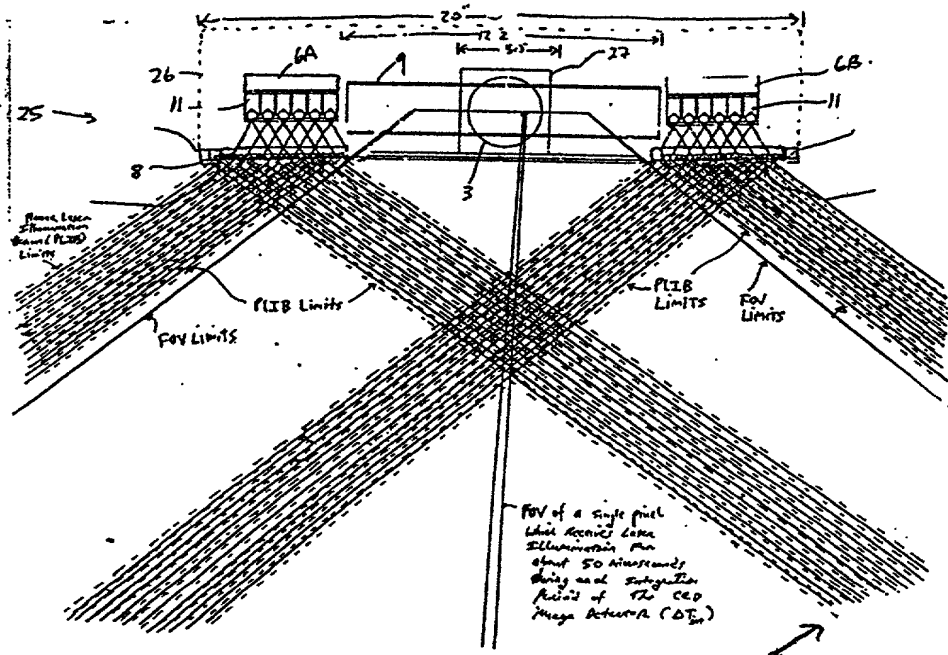


FIG. 1116

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TPMF

FIG. 1 I 16A

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Third Generalized Speckle-Noise Pattern Reduction Method
Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal *phase* of the transmitted PLIB ~~along the planar extent thereof~~ according to a *temporal phase* modulation function (TPMF) so as to:

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.



Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce power of the speckle-noise pattern observed at the image detection array.

FIG. 1I/6B

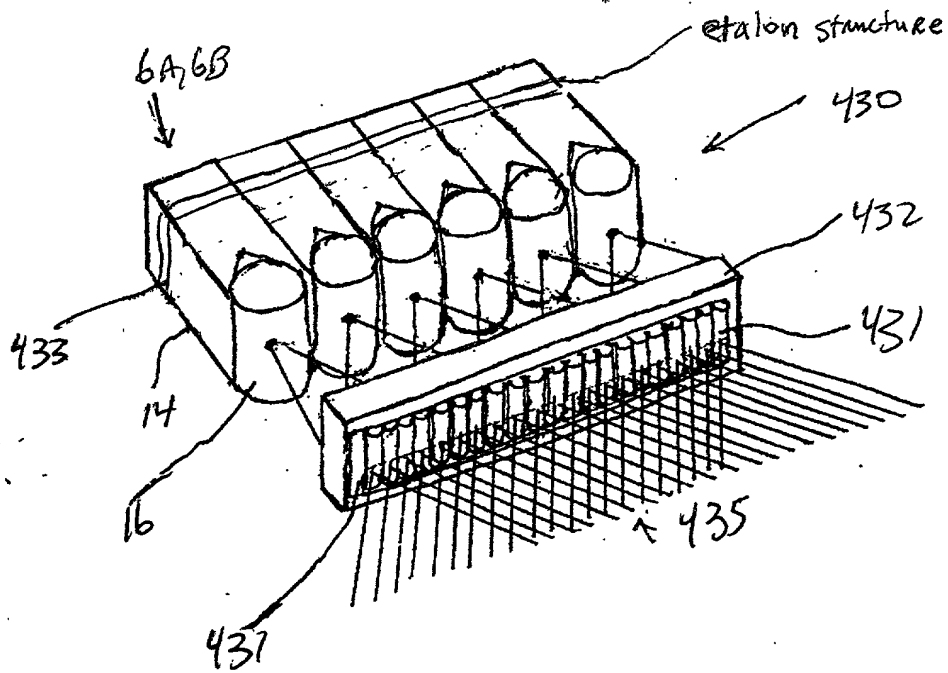
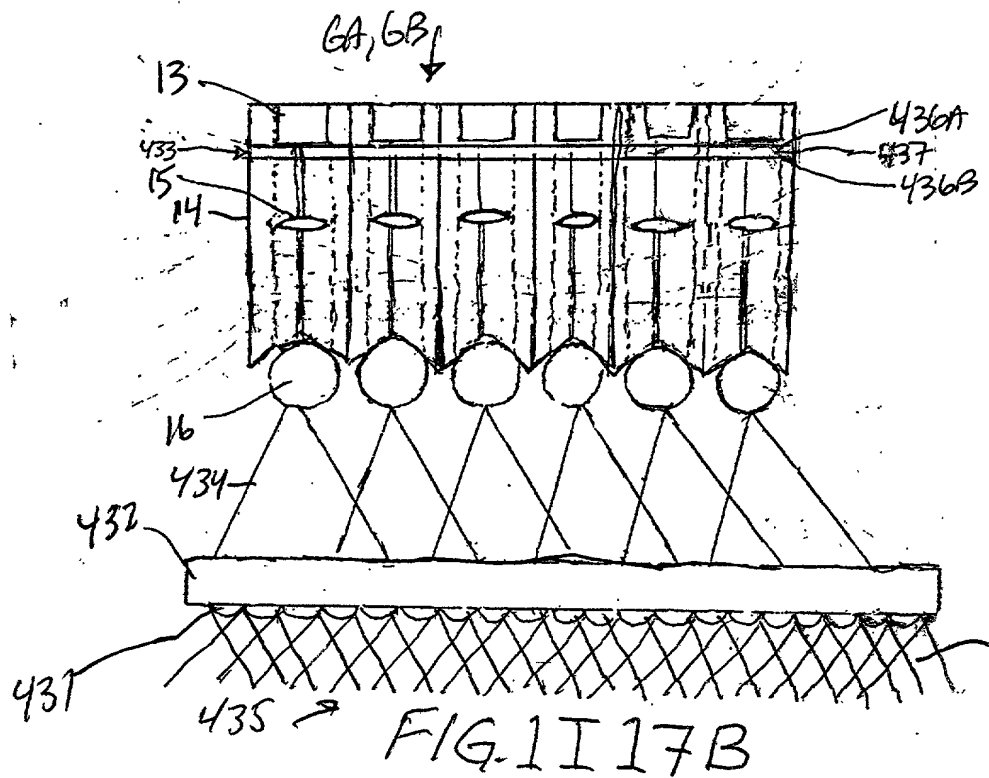


FIG. 1I17A



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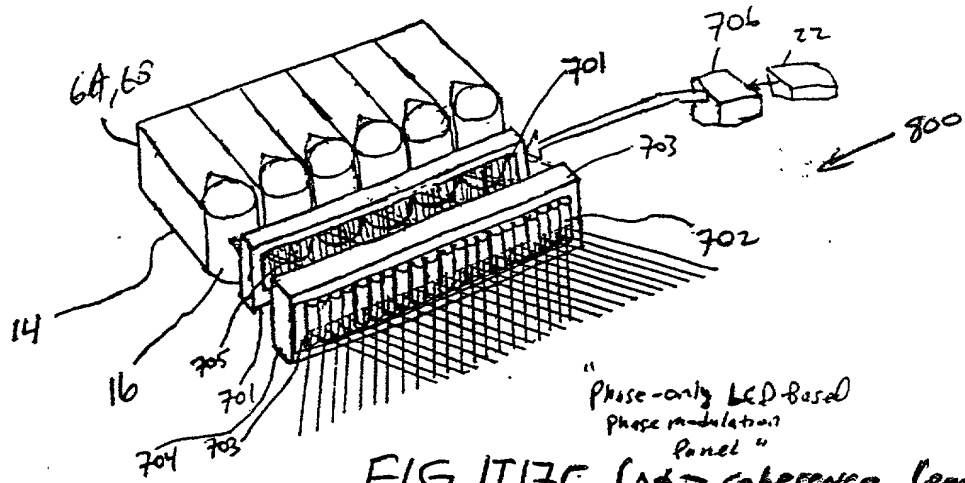


FIG. 1I17C ($\Delta\phi > \text{coherence length}$)
of VLD

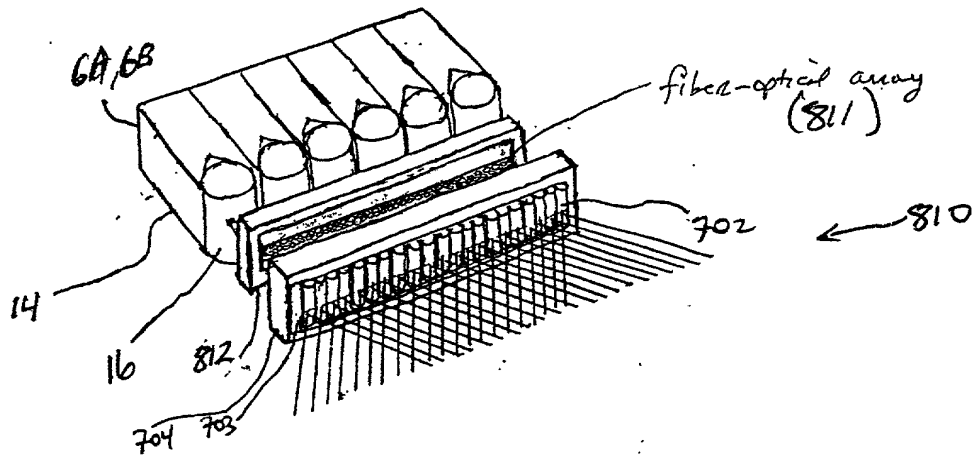


FIG. 1I17D

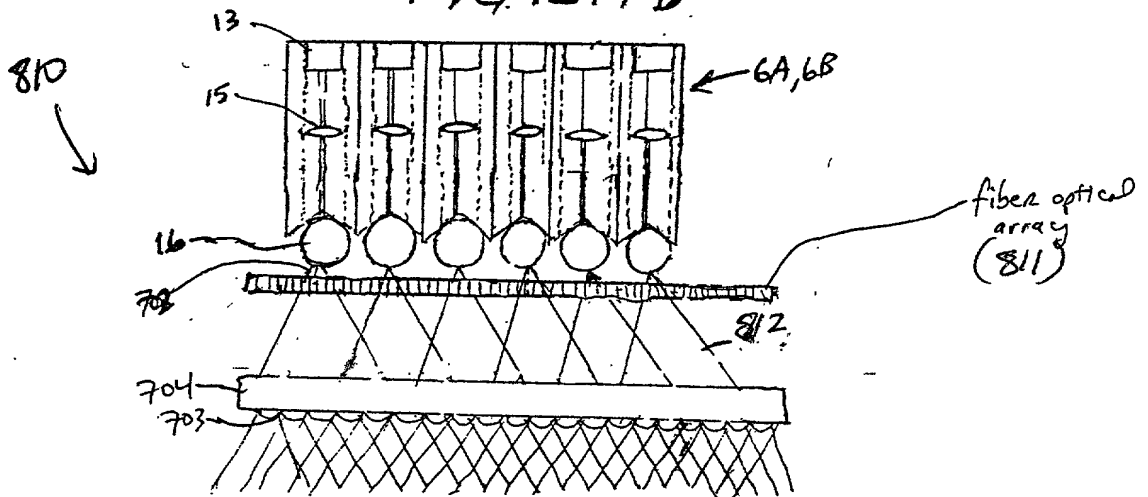


FIG. 1I17E

Fourth Generalized Method of
Reducing Speckle-Noise Patterns
at Image Detection Array
of the FFD Subsystem (3)

(TFMF)

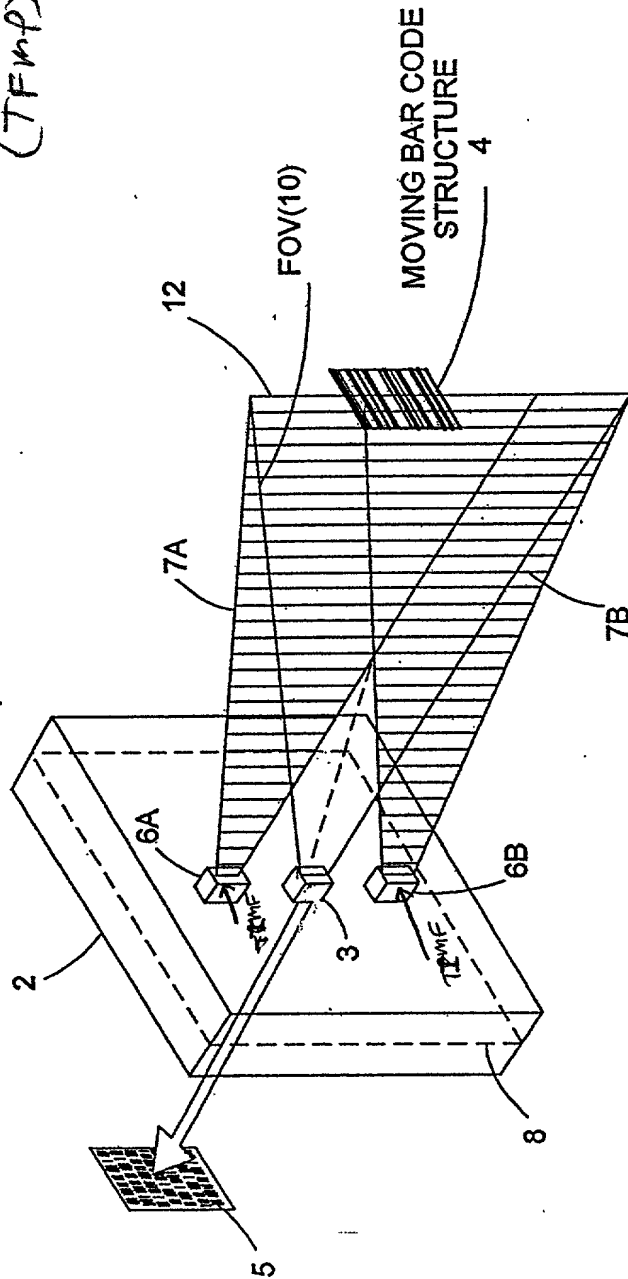


FIG. 1118

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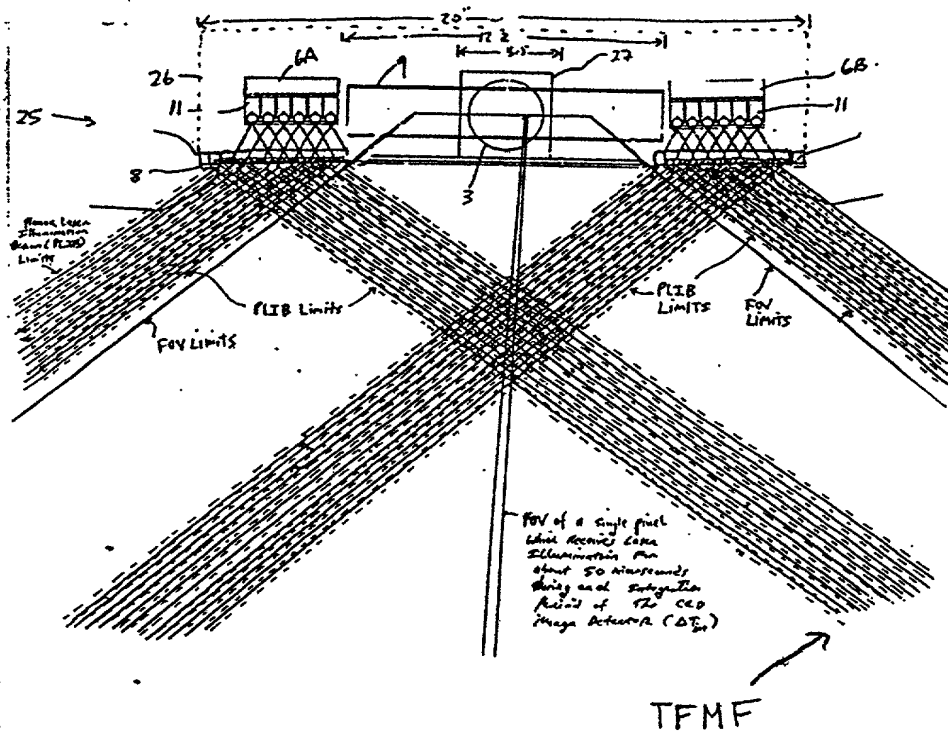


FIG. 1 I 18A

Fourth Generalized Speckle-Noise Pattern Reduction Method
Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal frequency of the transmitted PLIB according to a temporal intensity modulation function (T IMF) so as to :

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

↓

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce power of the speckle-noise pattern observed at the image detection array.

FIG. 1I18B

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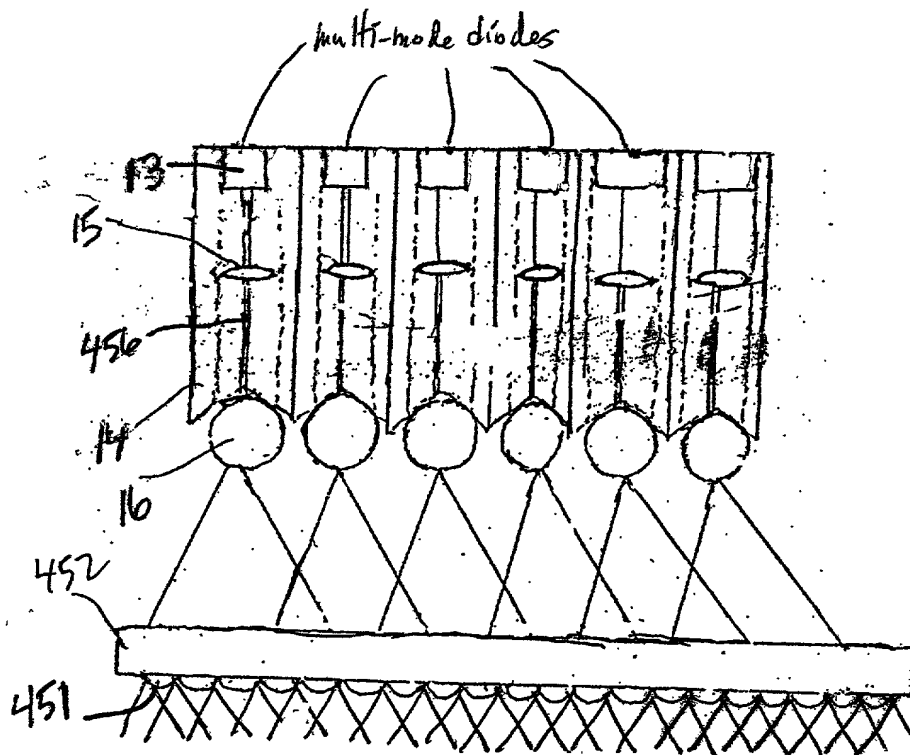


FIG 1I19C

Fifth Generalized Method
of Reducing Speckle-Noise
Patterns At Image
Detection array of the
FFD subsystem (3)

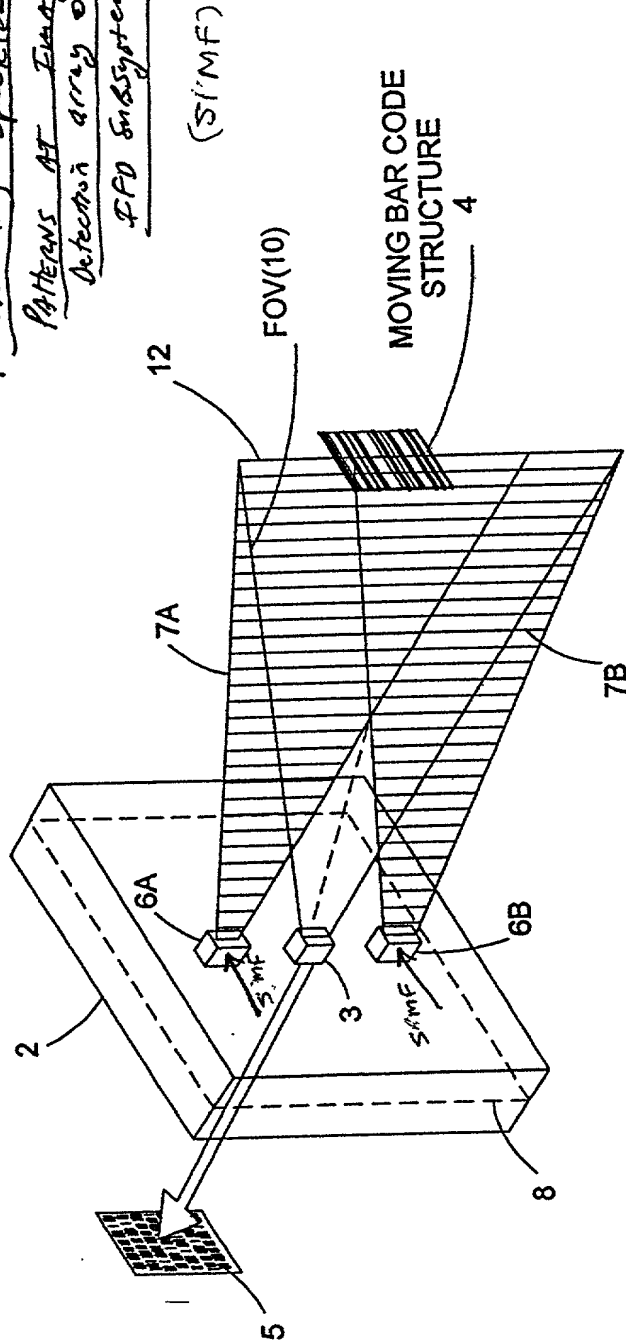
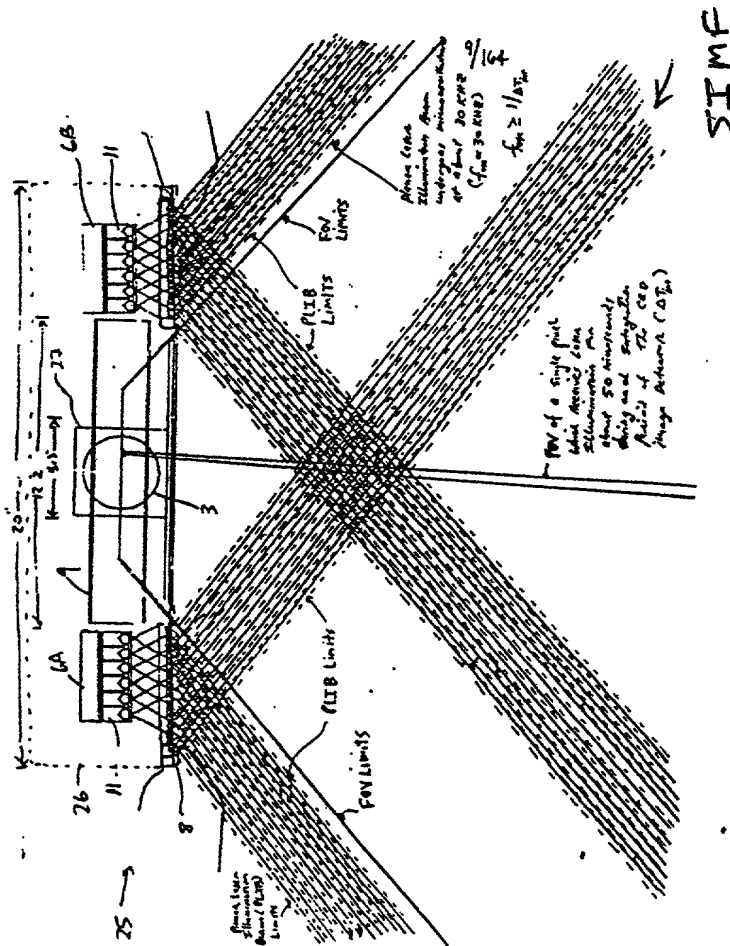


FIGURE 20

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Prior to object illumination

FIG. 1I 20A

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Fifth Generalized Speckle-Noise Pattern Reduction Method
Of The Present Invention

Prior to illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the transmitted PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

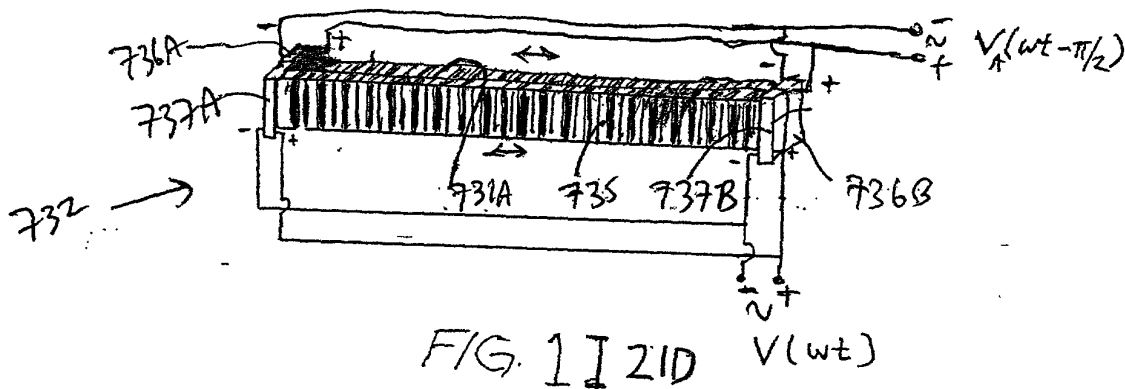
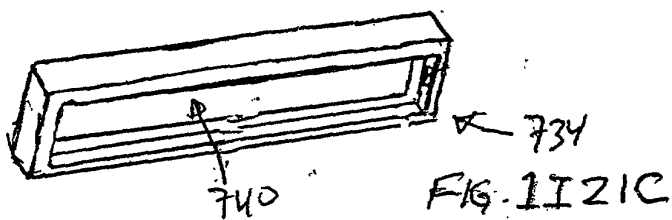
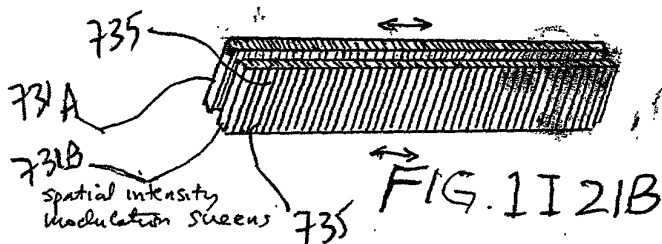
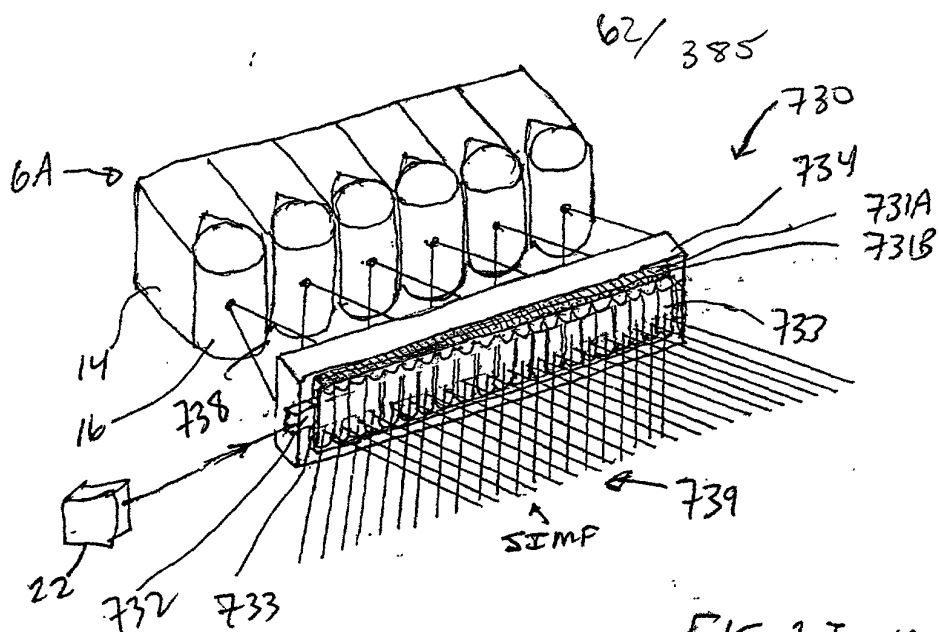
A

↓

Temporally average the numerous substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce power of the speckle-noise pattern observed at the image detection array.

B

FIG. 1I20B



Generalized Method of
Reducing Speckle-Noise Patterns
at Image Detection array
of the IFD Subsystem
 (SIMF)

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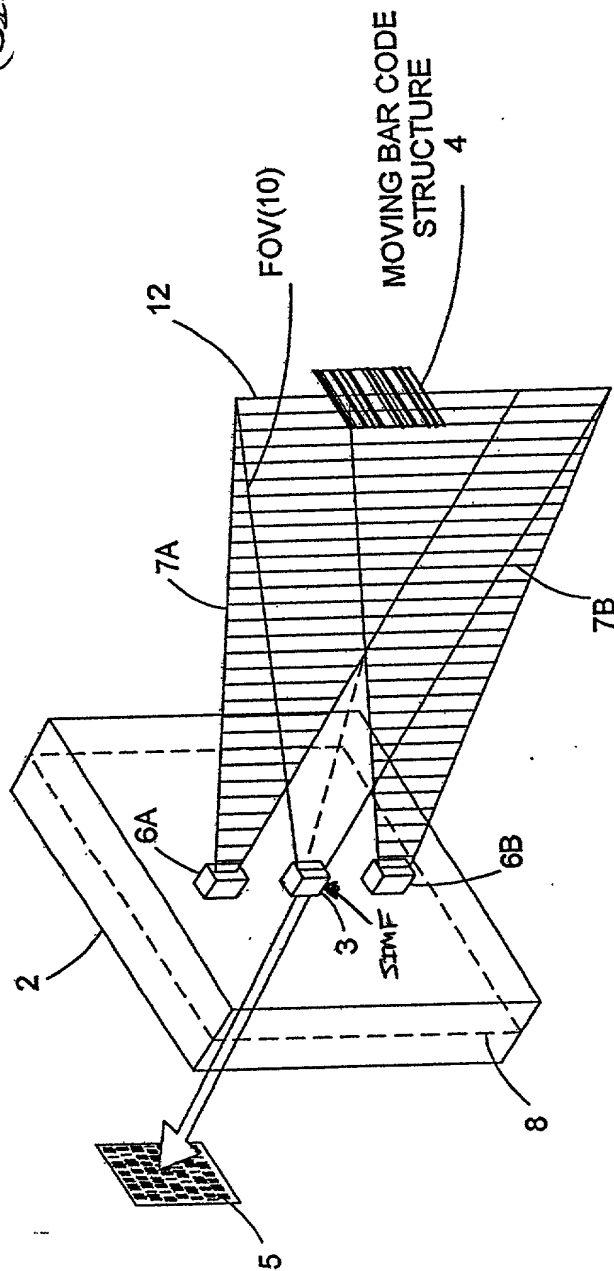


FIG. 1122

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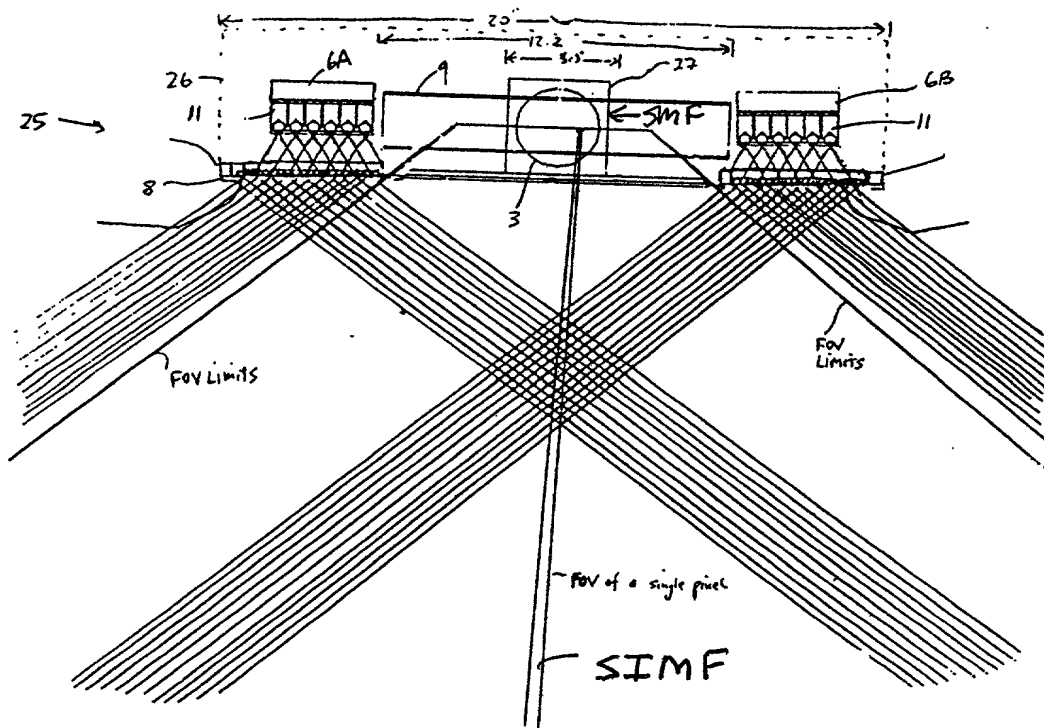


FIG. 1122A

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Sixth Generalized Speckle-Noise Pattern Reduction Method
Of The Present Invention

After illumination of the target with the planar laser illumination beam (PLIB), modulate the spatial intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a spatial intensity modulation function (SIMF) so as to :

produce numerous substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the many substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array.

FIG. 1I 22B

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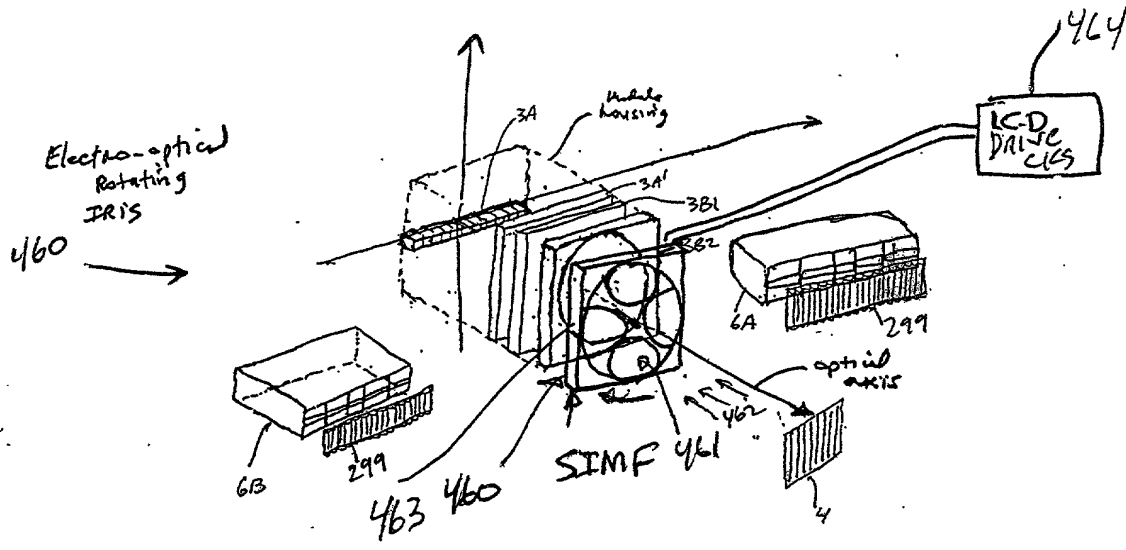


FIG. 1I 23A

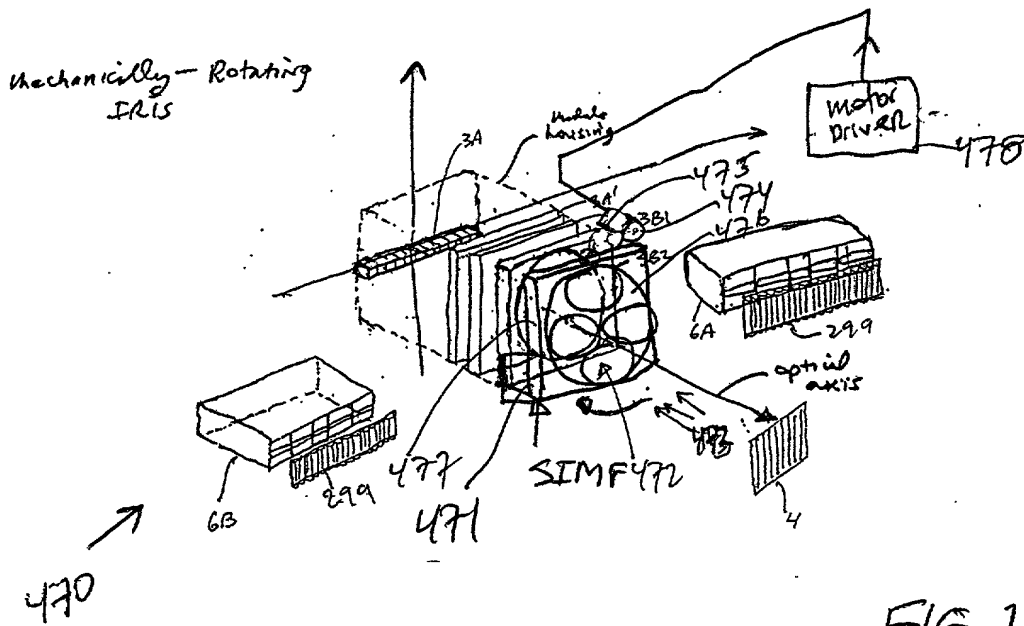


FIG. 1I 23B

Seventh Generalized Method of
Reducing Speckle-Noise Patterns
at Image Detection Array
of the IFD Subsystem

(TMF)

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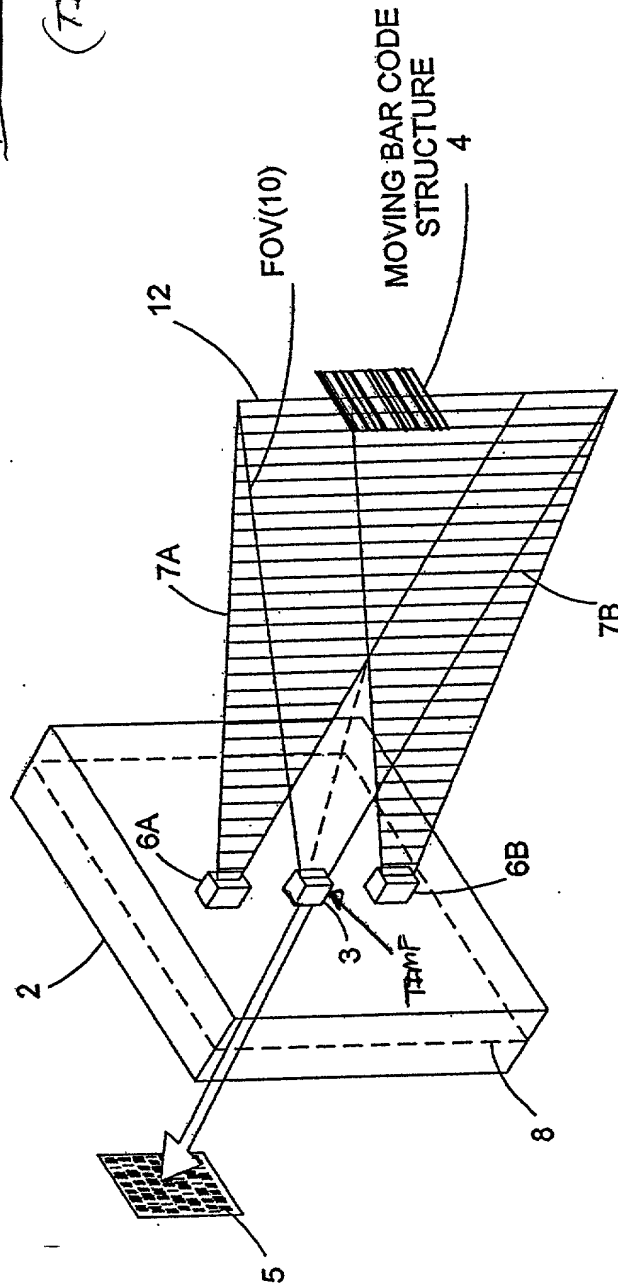


FIG. 1124

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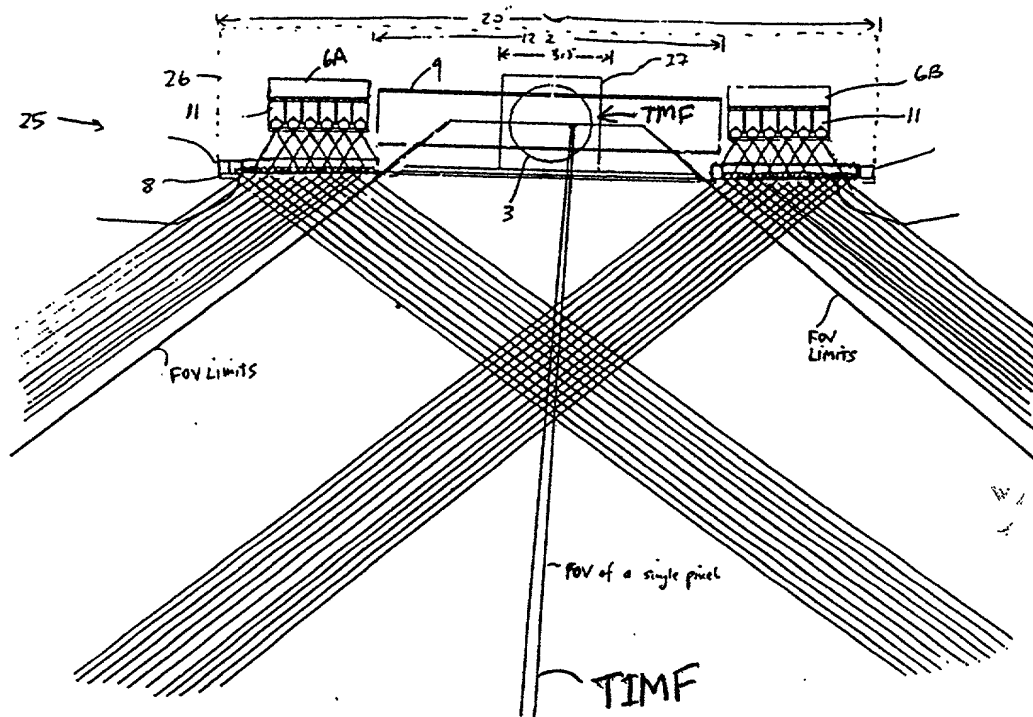


FIG. 1I24A

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Seventh Generalized Speckle-Noise Pattern Reduction Method
Of The Present Invention

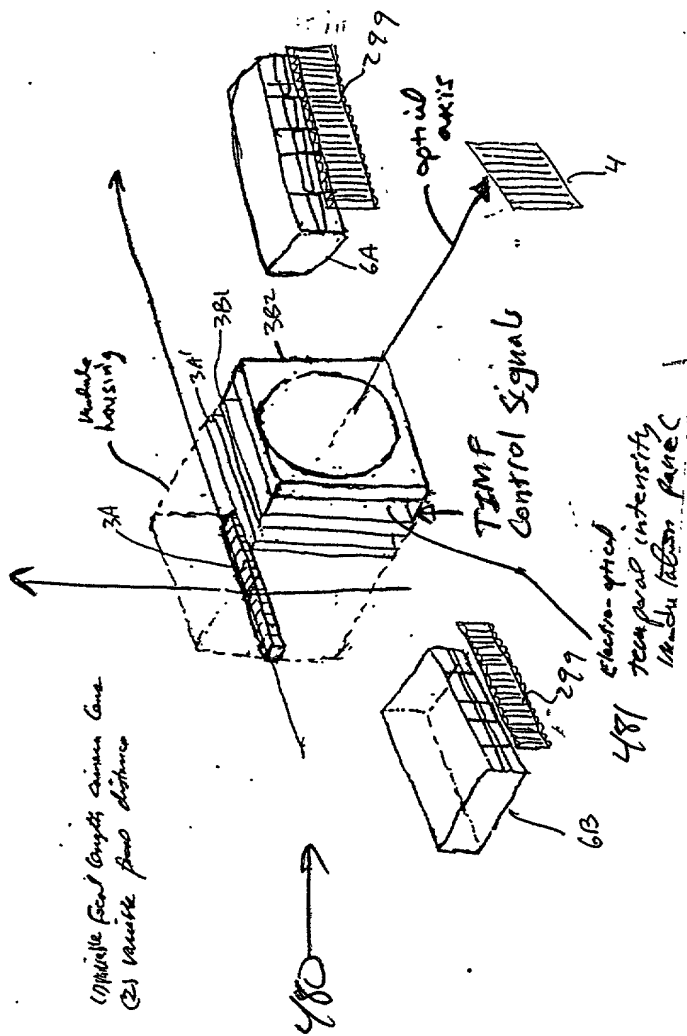
After illumination of the target with the planar laser illumination beam (PLIB), modulate the temporal intensity of the reflected/scattered (i.e. received) PLIB along the planar extent thereof according to a temporal intensity modulation function (TIMF) so as to

produce many substantially different time-varying speckle-noise patterns at the image detection array of the IFD Subsystem during the photo-integration time period thereof.

Temporally average the many substantially different time-varying speckle-noise patterns produced at the image detection array in the IFD Subsystem during the photo-integration time period thereof, so as to thereby reduce the speckle-noise pattern observed at the image detection array.

FIG. 1I 24B

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AG 1I 24C

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EIGHT GENERALIZED METHOD OF REDUCING THE SPECKLE PATTERN
NOISE OBSERVED IN PLIIM-BASED IMAGING SYSTEMS

A

Use a PLIIM-BASED Imager to produce a series of consecutively captured digital images of an object over a series of photo-integration time periods of the PLIIM-Based Imager, wherein each digital image of the object includes a substantially different speckle noise pattern produced by natural oscillatory micro-motion and/or forced oscillatory micro-movement of the Imager relative to the object during operation of the PLIIM-Based Imager.

B

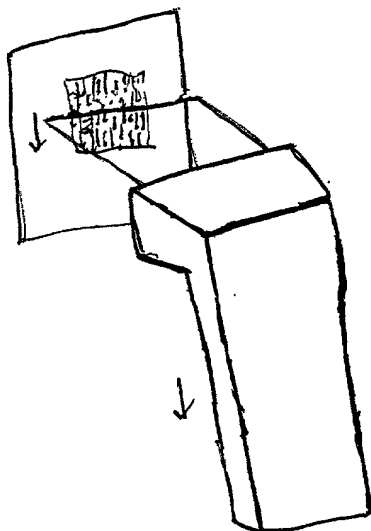
Store the series of consecutively captured digital images of the object in buffer memory within the PLIIM-Based Imager.

C

Add relatively small (e.g. 3x3) windowed image processing filters to the additively combine and average the pixel data in the series of consecutively captured digital images so as to produce a reconstructed digital image having a speckle noise pattern with reduced RMS power.

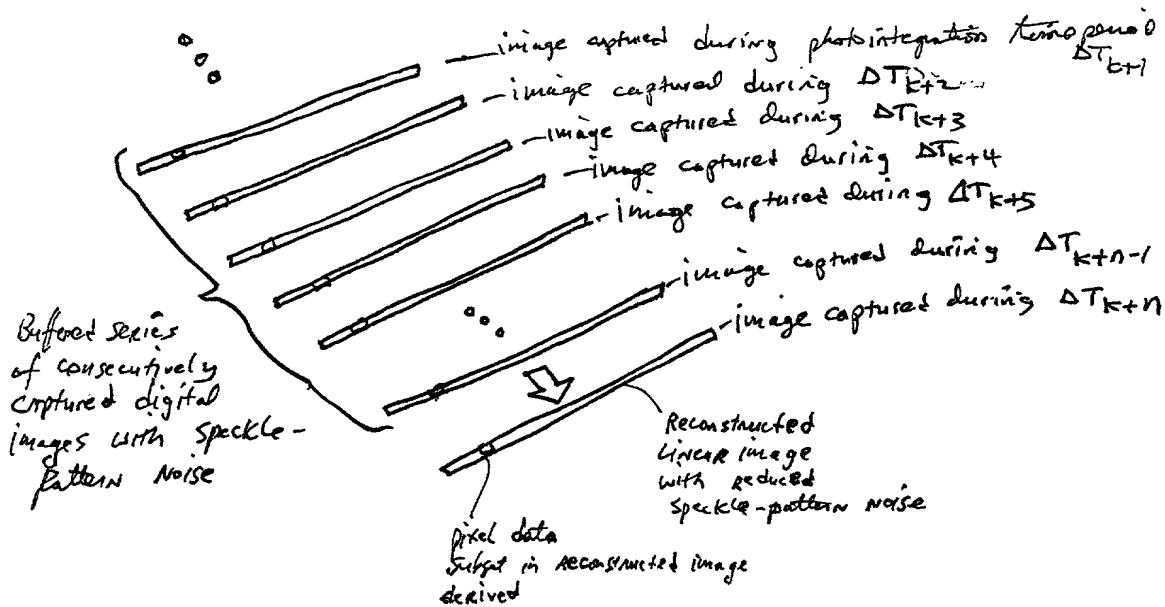
FIG. 1124D

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Manual
Sweeping
Action
across Code Symbol
or
graphical indicia

FIG. 1124E



Case: Linear images

FIG. 1124F

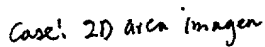
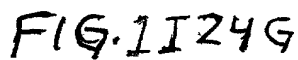
[illegible]

FIG 1I24H

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NINTH GENERALIZED METHOD OF REDUCING SPECKLE PATTERN
NOISE IN PLIIM-BASED IMAGING SYSTEMS

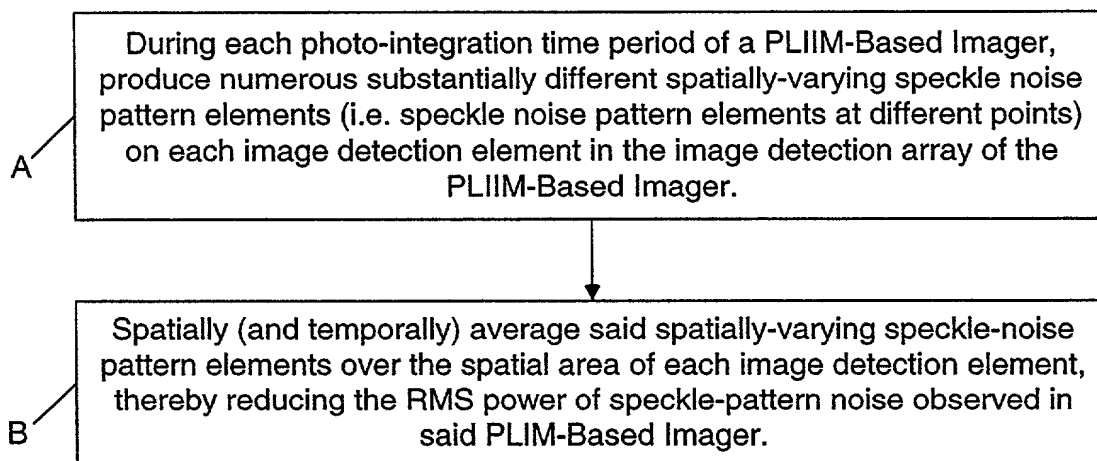


FIG. 1124I

FIG. 1I25A1

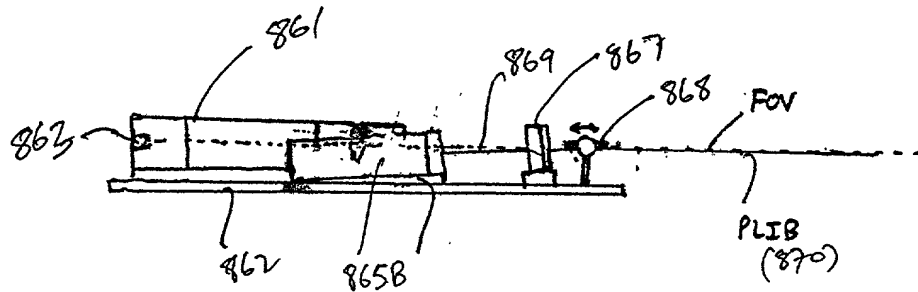


FIG. 1 IZ5A2

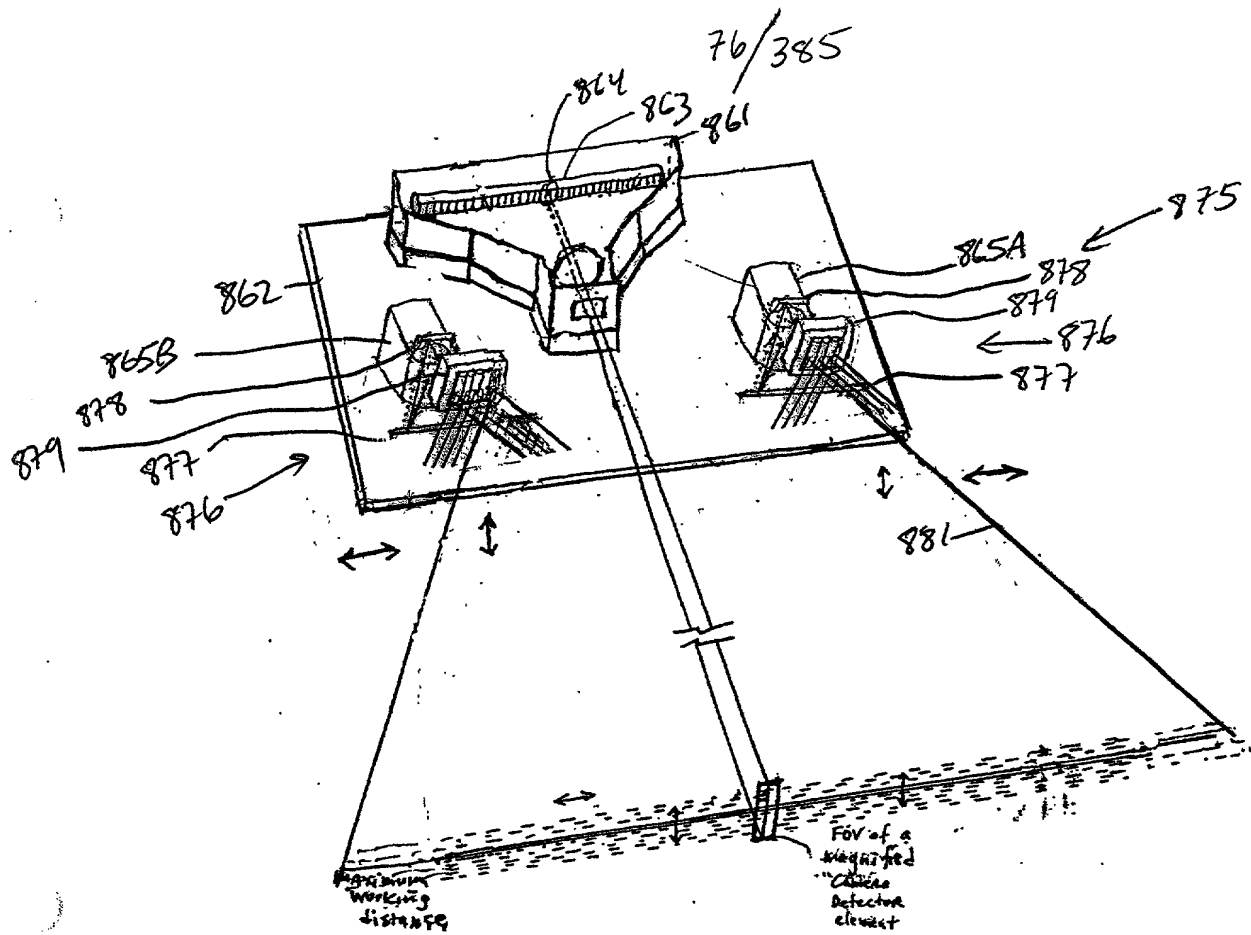


FIG. 1 I 25 B 1

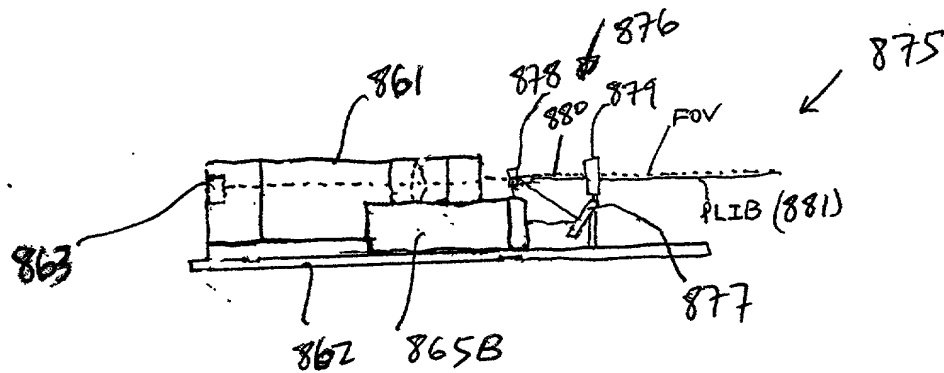
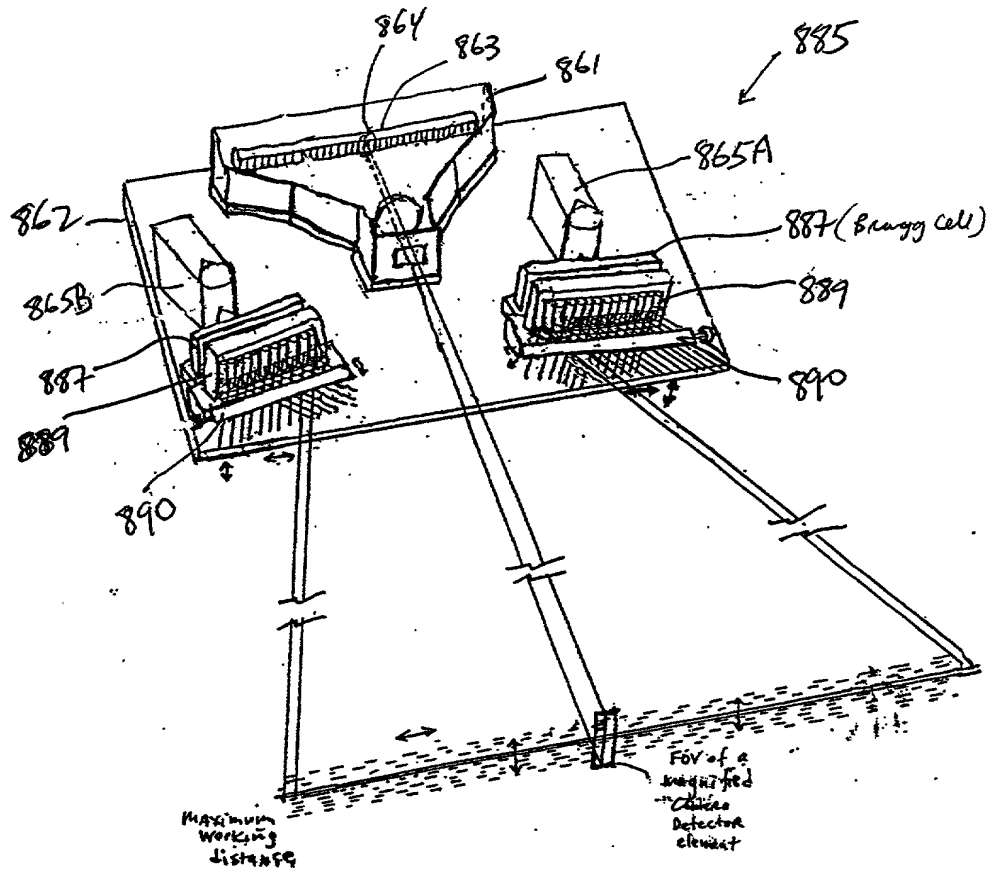


FIG. 1 I 25 B 2

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* Lateral and Transverse Microoscillation of PLIB

FIG. 1I25C1

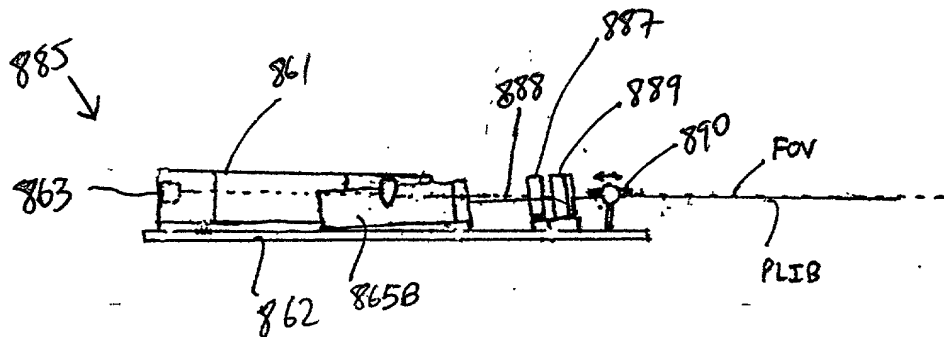
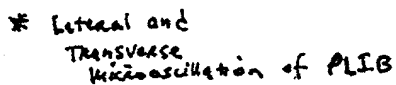
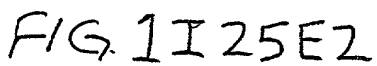


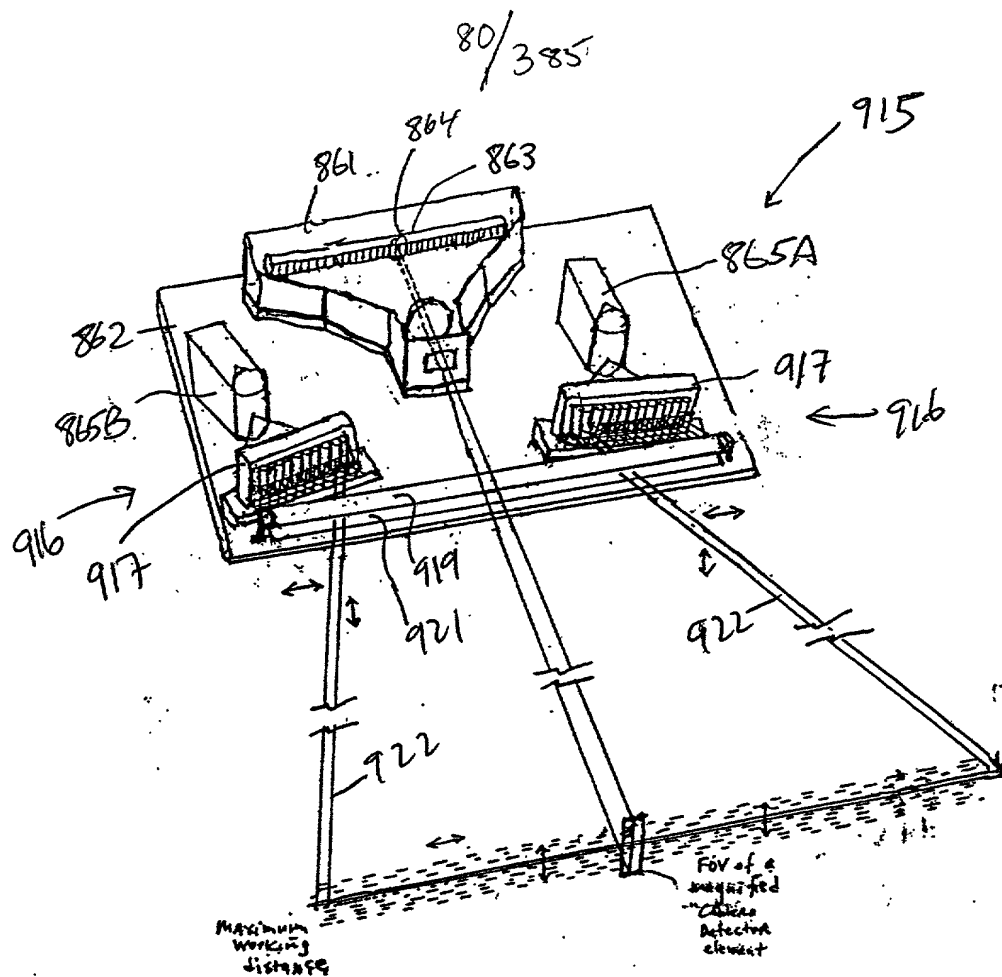
FIG. 1I25C2

Variable	Mean		SD		t		p	
	Control	Case	Control	Case	Control	Case	Control	Case
Age	30.5	30.5	1.2	1.2	0.0	0.0	0.999	0.999
Gender	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Education	12.0	12.0	1.0	1.0	0.0	0.0	0.999	0.999
Income	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Marital status	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Occupation	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Religion	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Health status	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Family size	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Urban/rural	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Season	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Weather	1.0	1.0	0.0	0.0	0.0	0.0	0.999	0.999
Time of day	1.0	1.0	0.0	0.0	0.0			



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* Lateral and Transverse Microoscillation of PLIB

FIG. 1I25F1

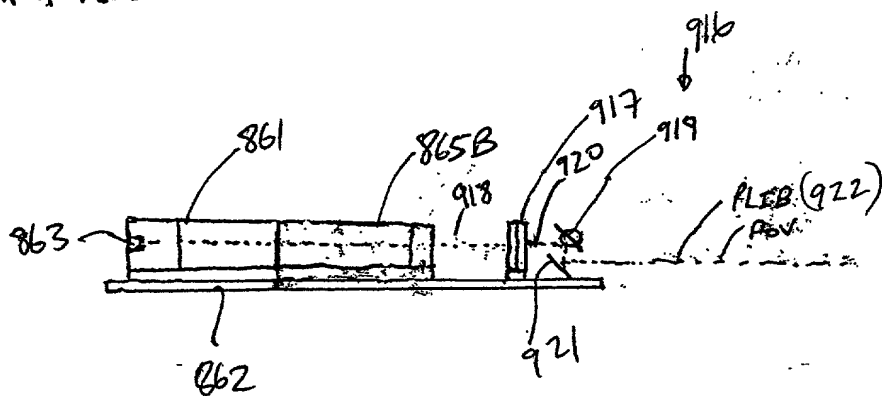
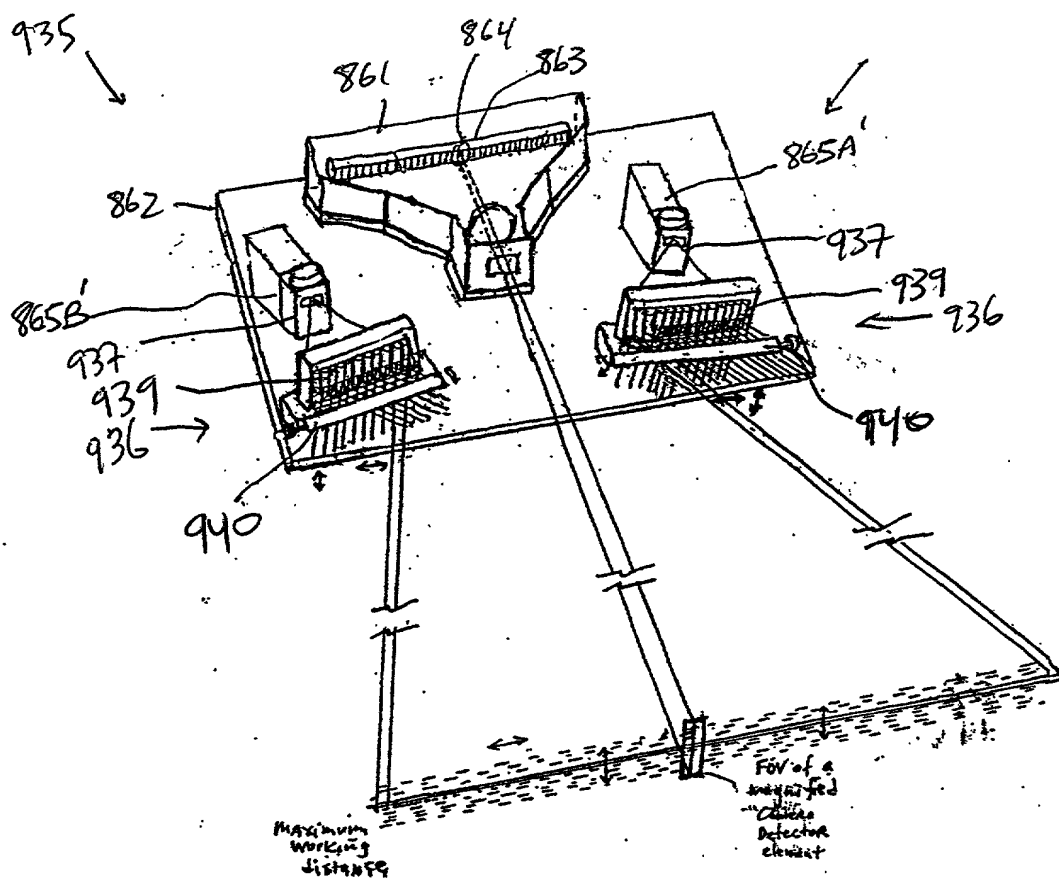


FIG. 1I25F2



- * Lateral and Transverse Flexion of PLIB

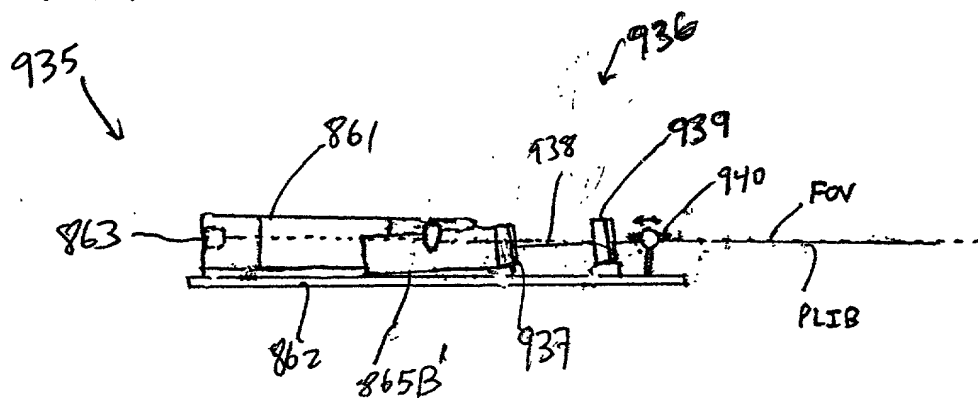
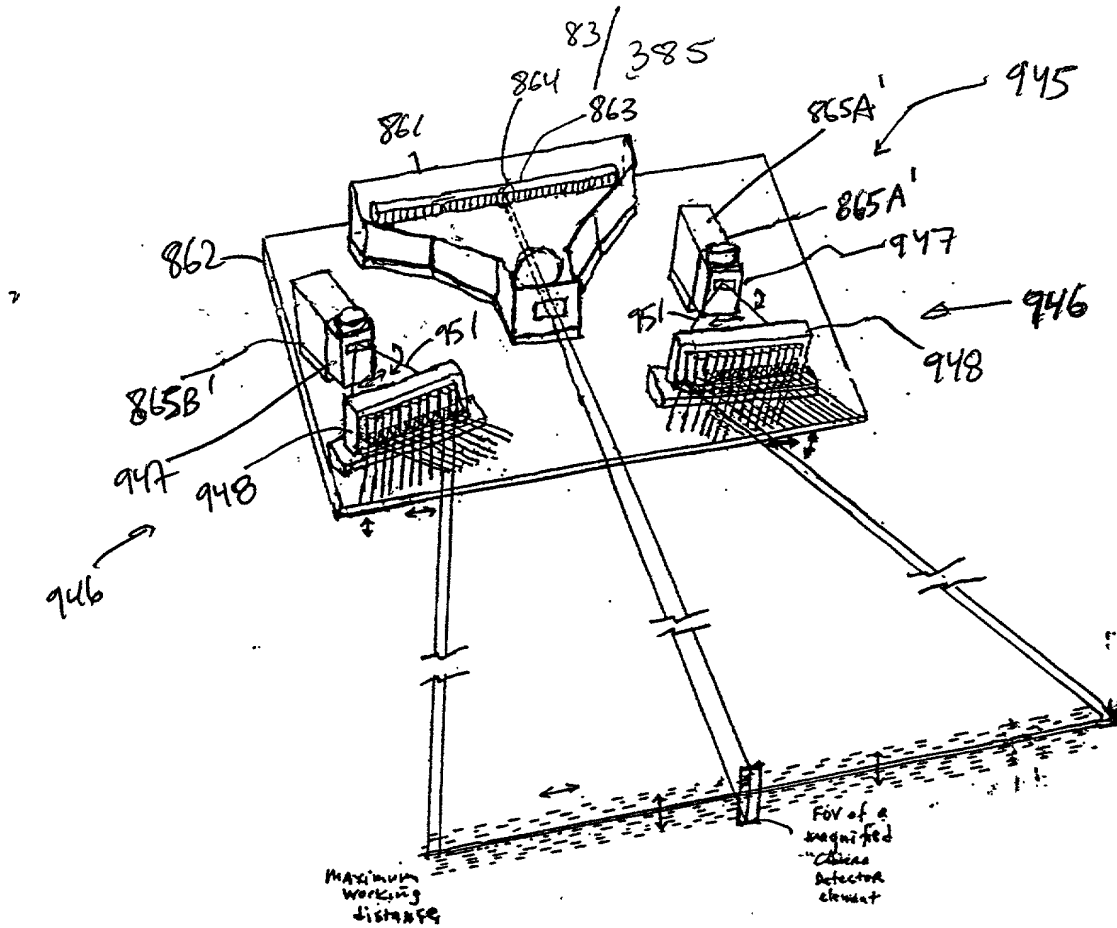
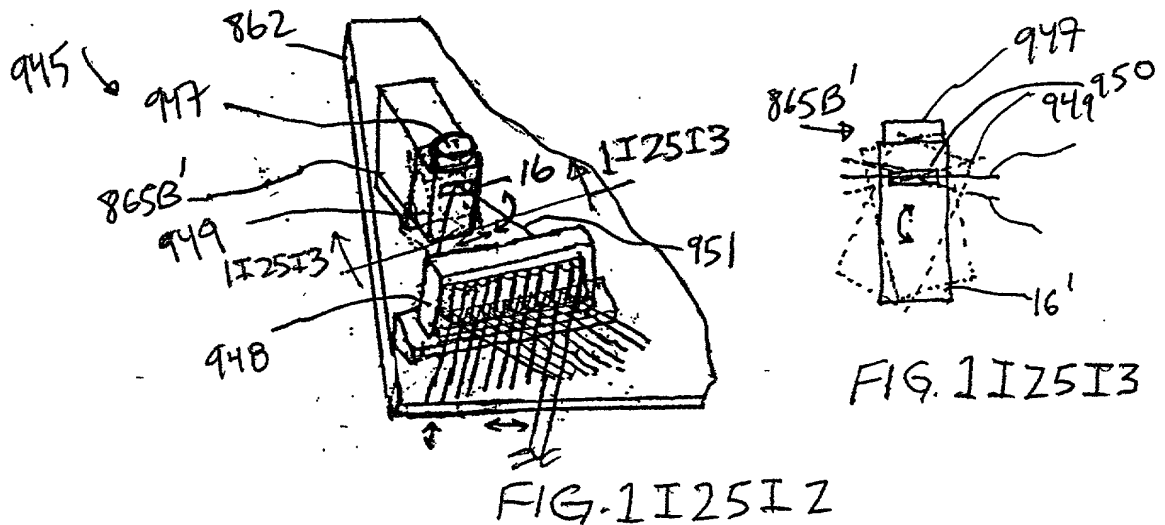


FIG. 1I25H2



Lateral and
 Transverse
 Maxilloprotrusion of PLIB

FIG. 1 I 25 I 1



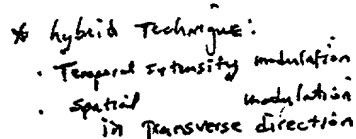


FIG. 1I25J1

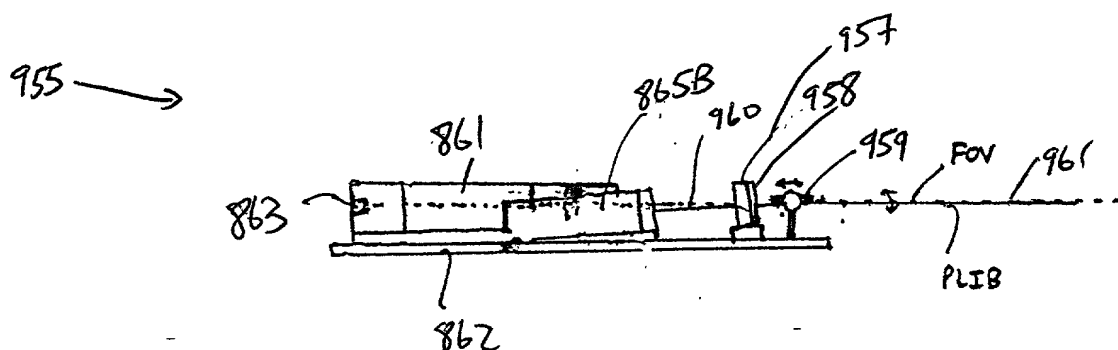


FIG. 1 I 25 J 2

* Hybrid Technique:

- Temporal Intensity mod.
- Spatial phase mod.

- * Hybrid Technique:
 - Temporal Intensity mod.
 - Spatial phase mod.

Maximum
Working
distance

FOV of a
simplified
China
Detector
element

FIG. 1 IZ5K1

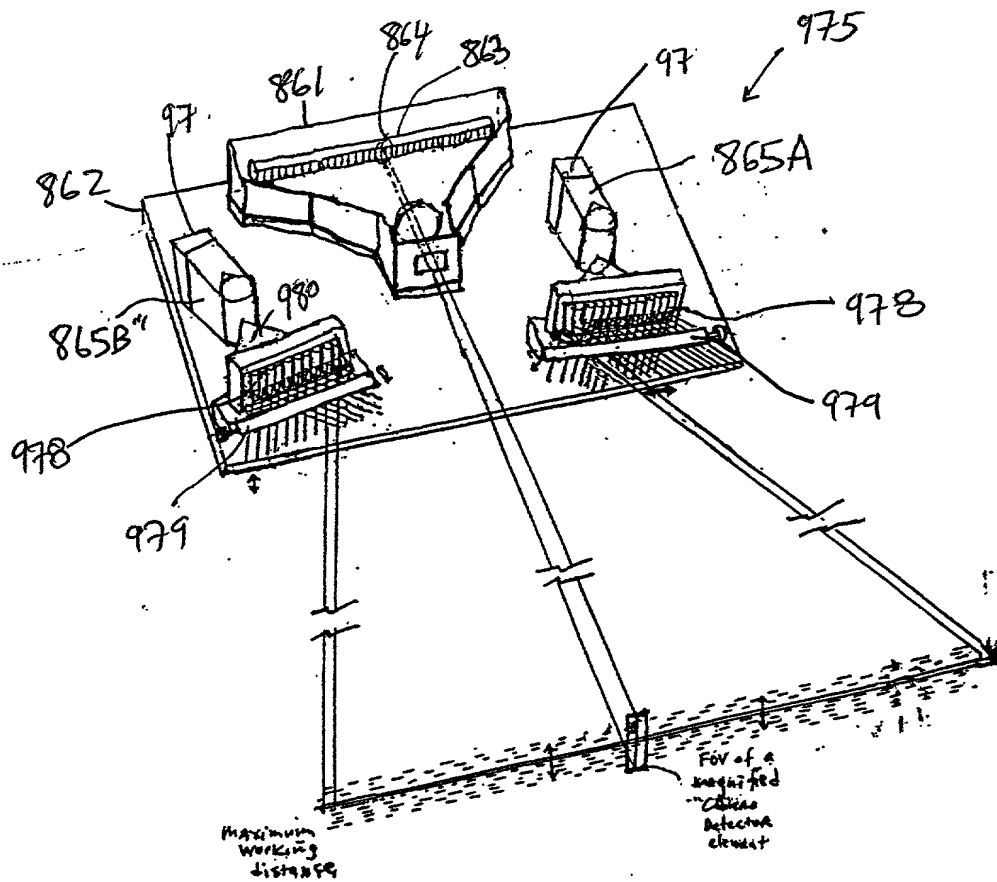
TRANSVERSE
Microoscillation of PLIB

965

Diagram illustrating a laser system for a vehicle, showing components such as the laser source (862), lens (863), mirrors (865B, 865A), and the resulting laser beam (967) directed towards a target (971). The diagram also shows the field of view (FOV) and a label 'PLIB'.

FIG. 1I 25KZ

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- * hybrid =
 - Temp. freq. mod.
 - Spatial phase mod.
- * Transverse
Modulation of PLIB

FIG. 1I25L1

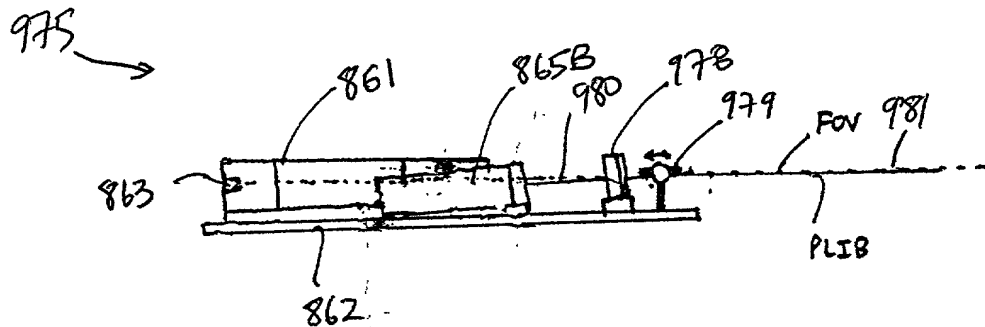


FIG. 1I25L2

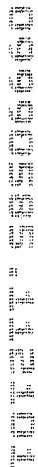


FIG. 1I 25M1

* Transverse
Microscission of PLIB

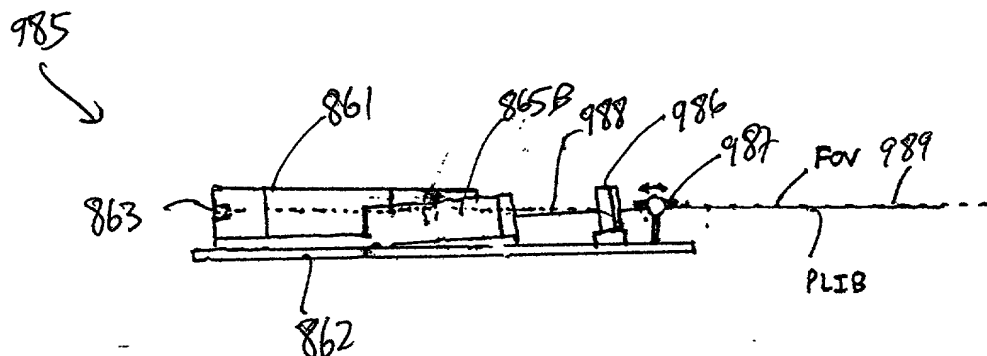
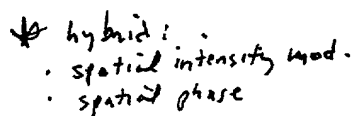


FIG. 1I 25M2



- * Lateral and Transverse Flexion of PLIB

FIG. 1125N1

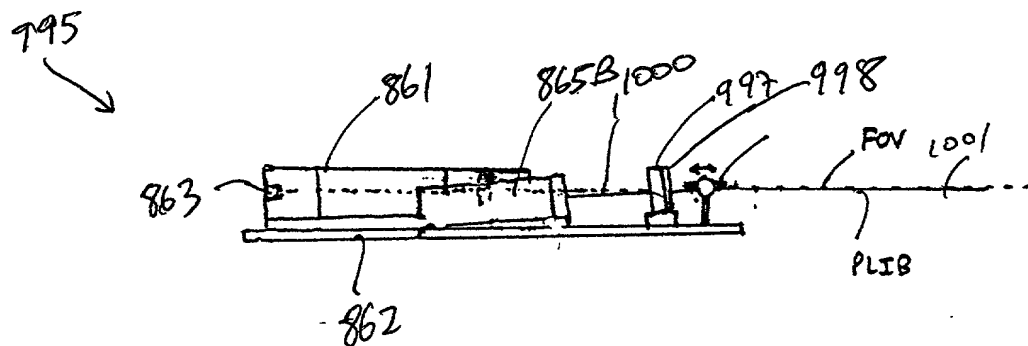


FIG. 1I25NZ

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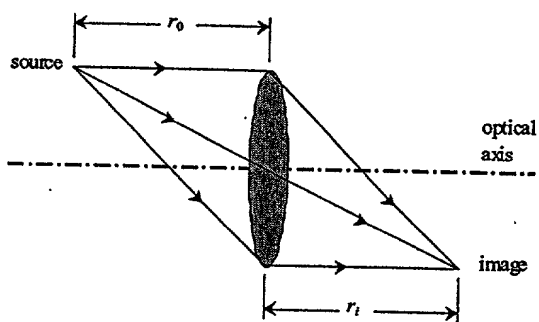


FIG. 1H1

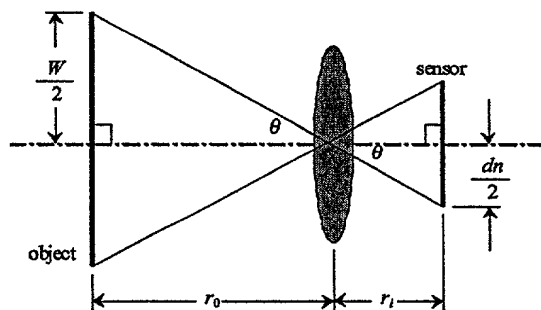


FIG. 1H2

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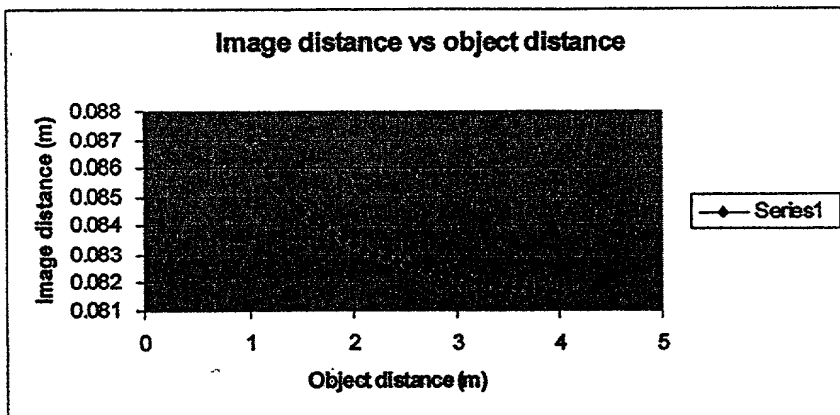


FIG. 1H3

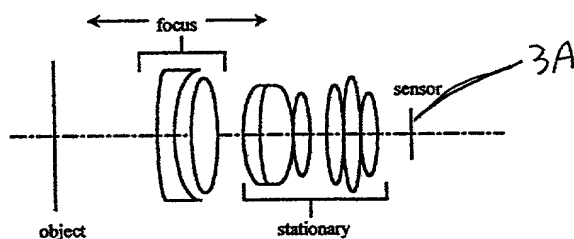


FIG. 1H4

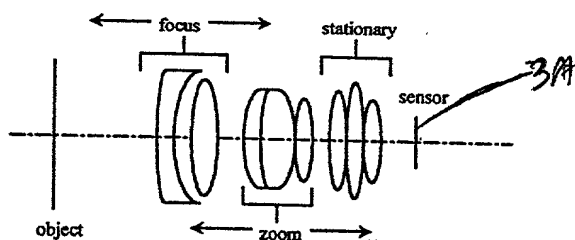


FIG. 1H5

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Fixed focal length lens
cases

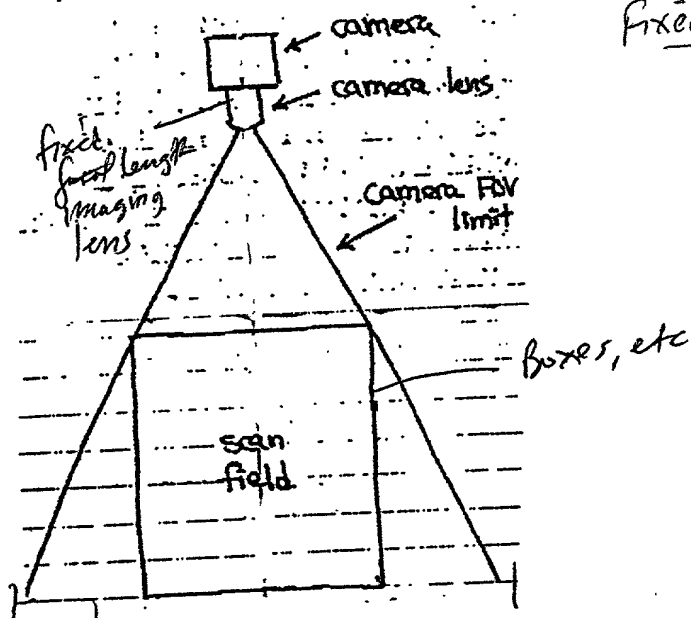


FIG. 1K1
conveyor 34

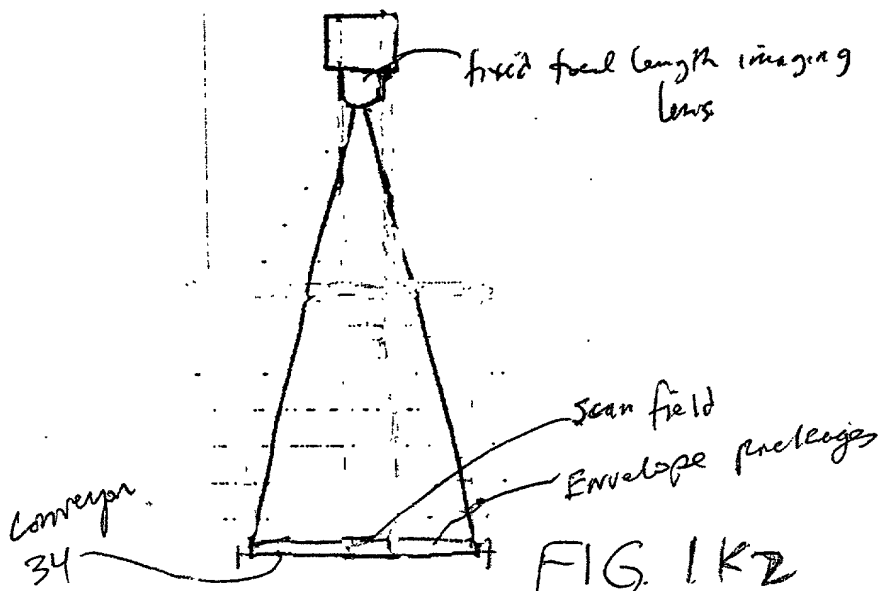


FIG. 1K2

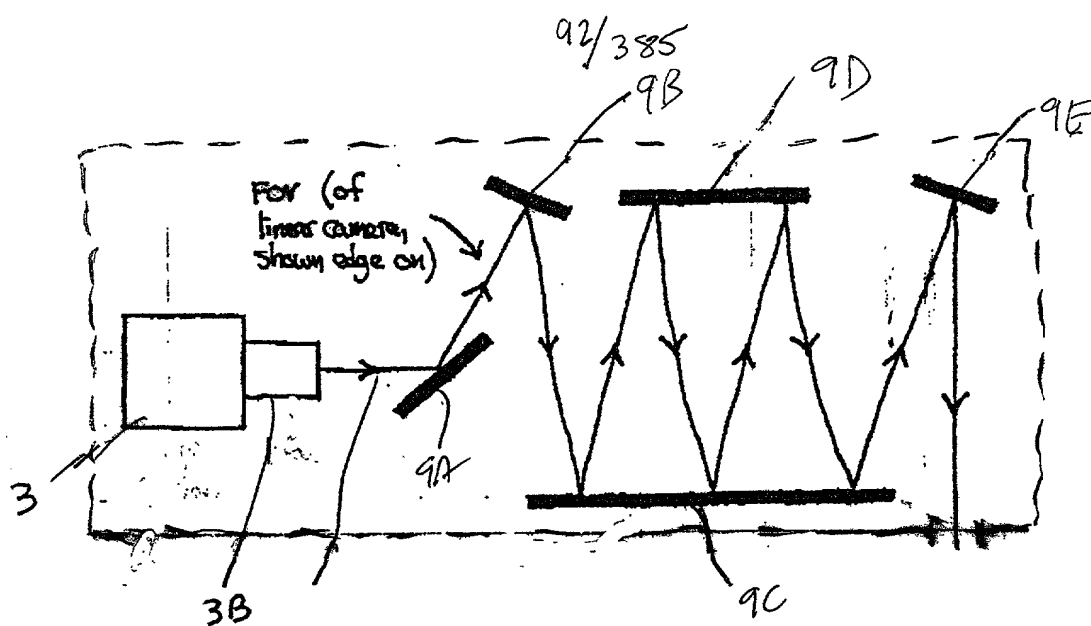


FIG. 1L1

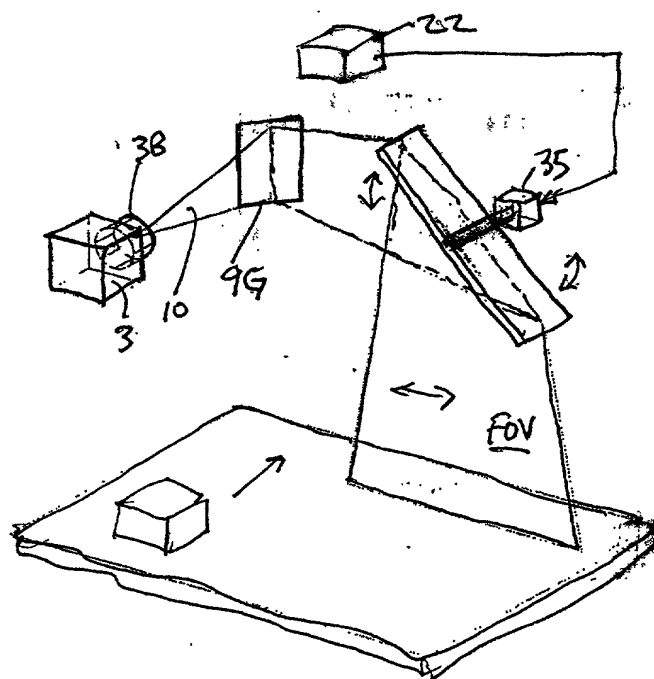


FIG. 1L2

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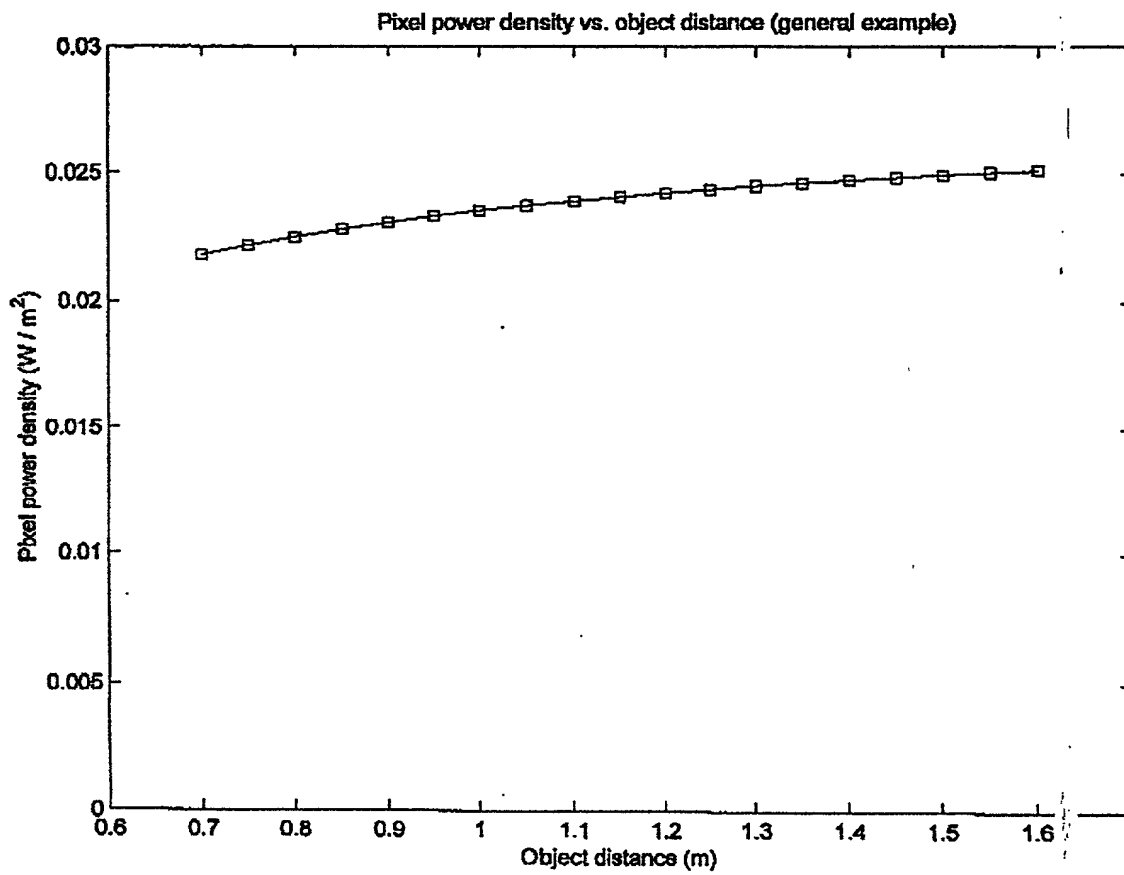


FIG-1M1

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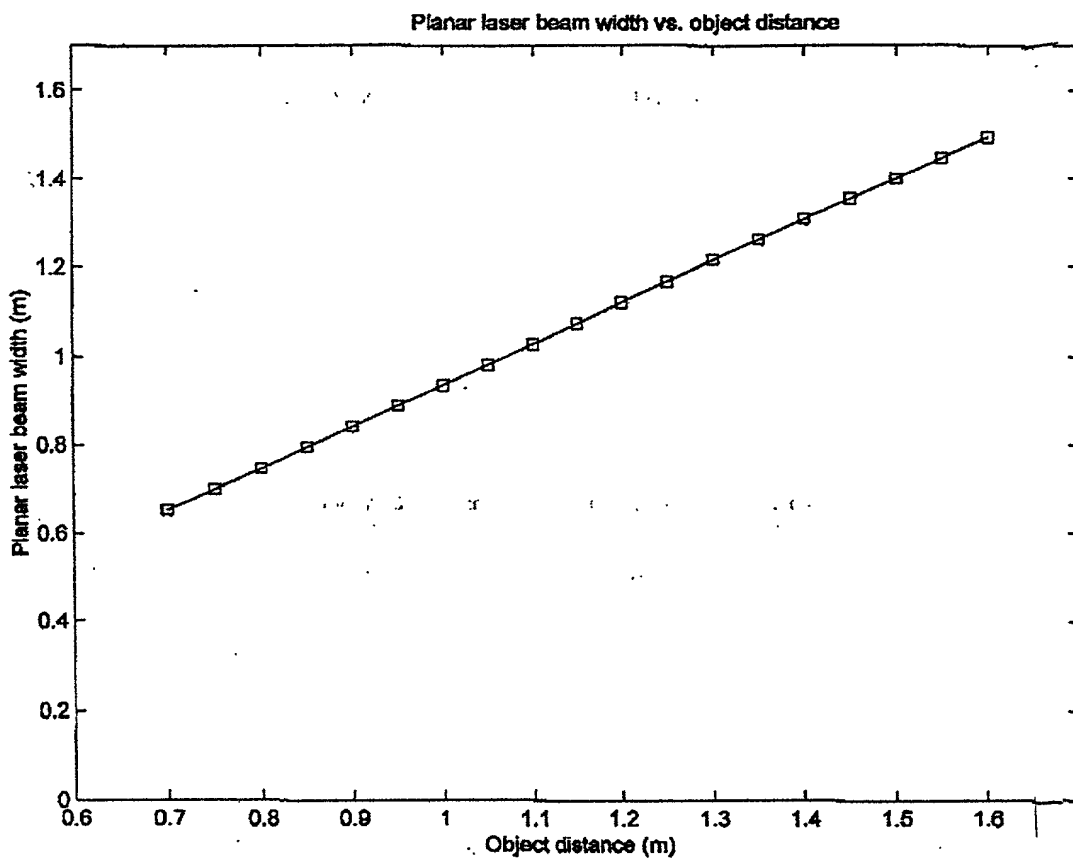
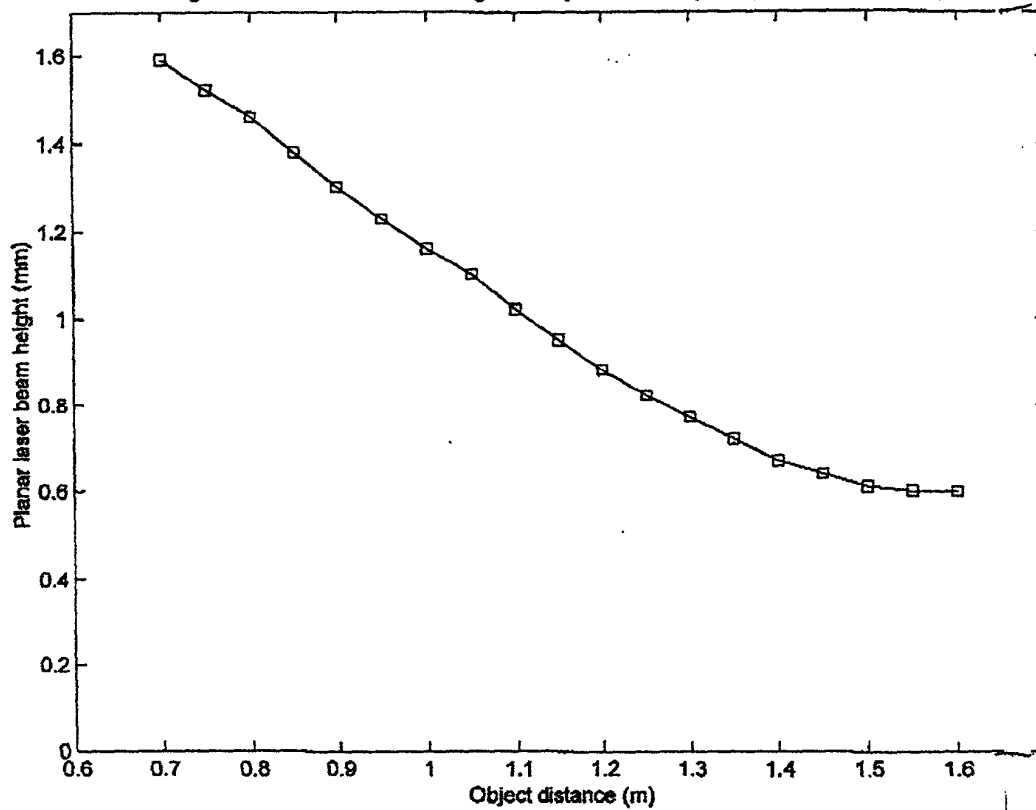


FIG. 1M3

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Figure 4: Planar laser beam height vs. object distance (far object distance focus)



FIG/M4

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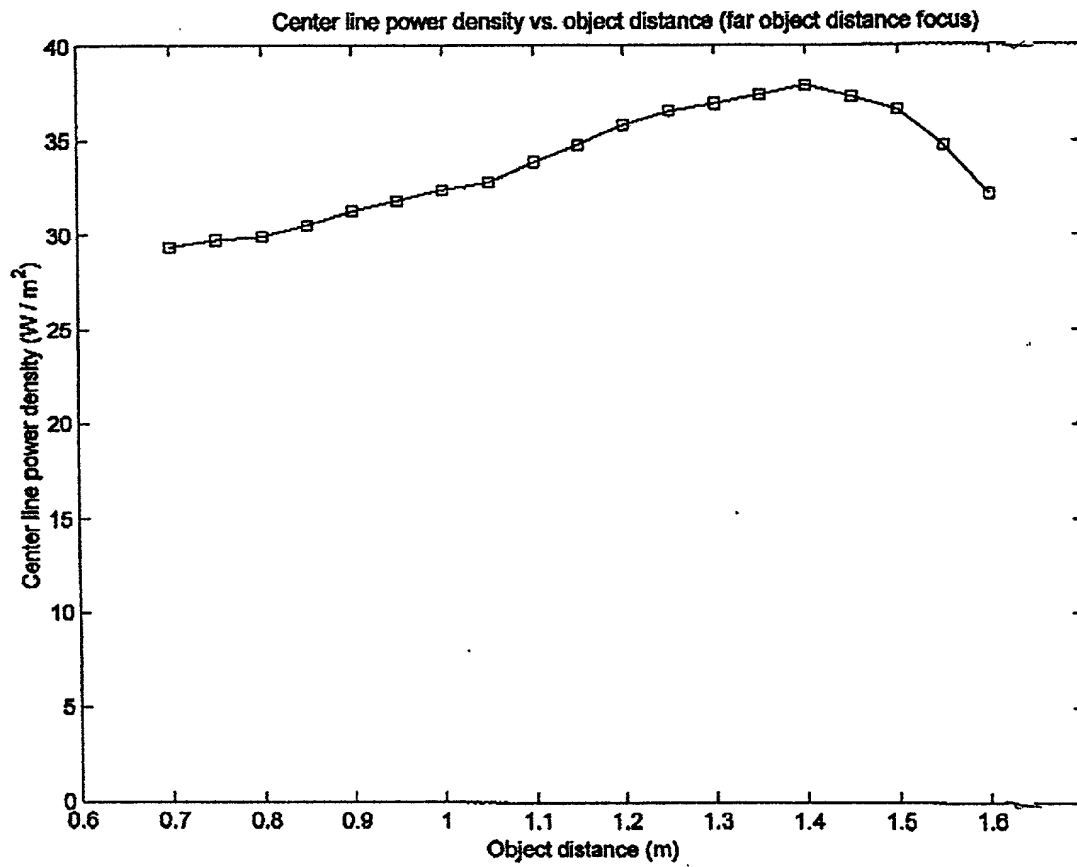


FIG. 1N

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Figure 6: Pixel power densities vs. object distance

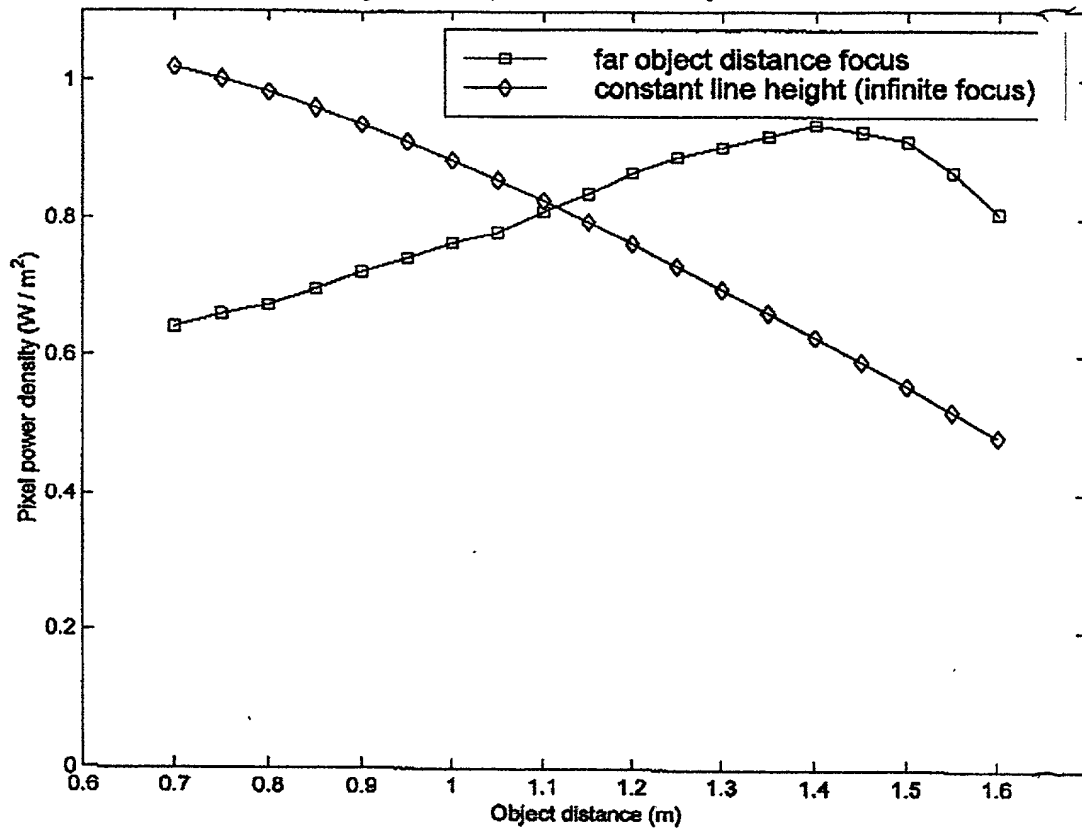


FIG. 10

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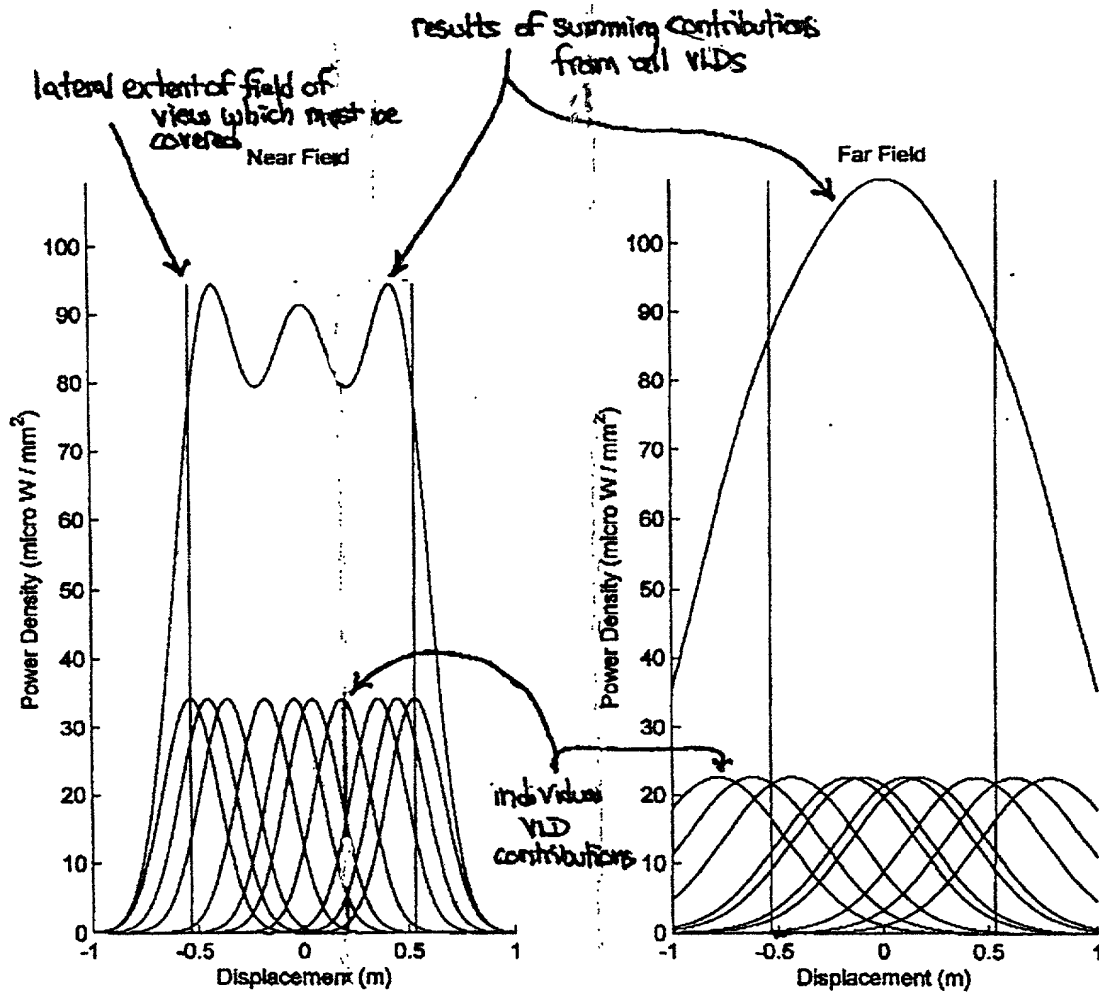


FIG 1P1

FIG 1P2

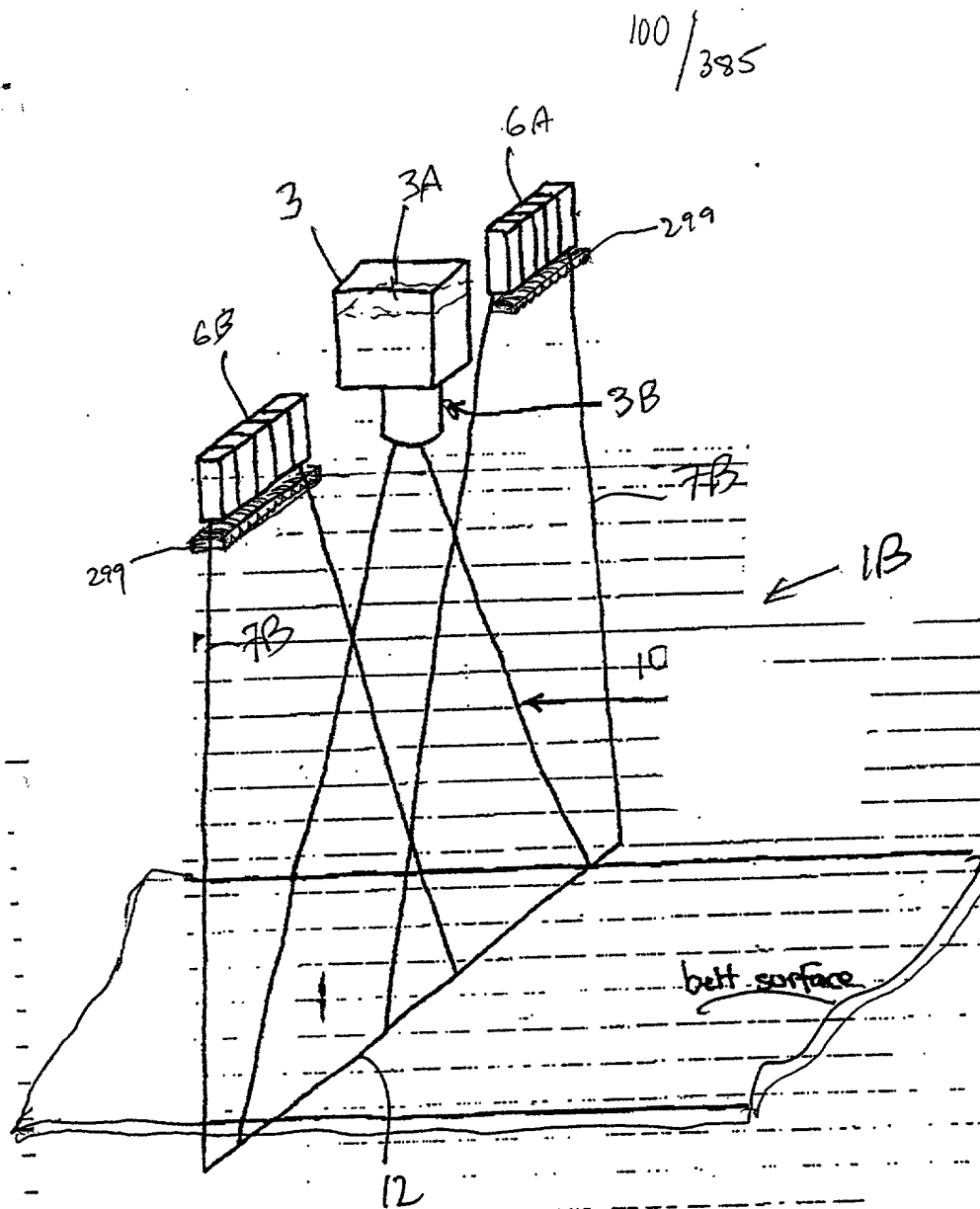


FIG. 1Q1

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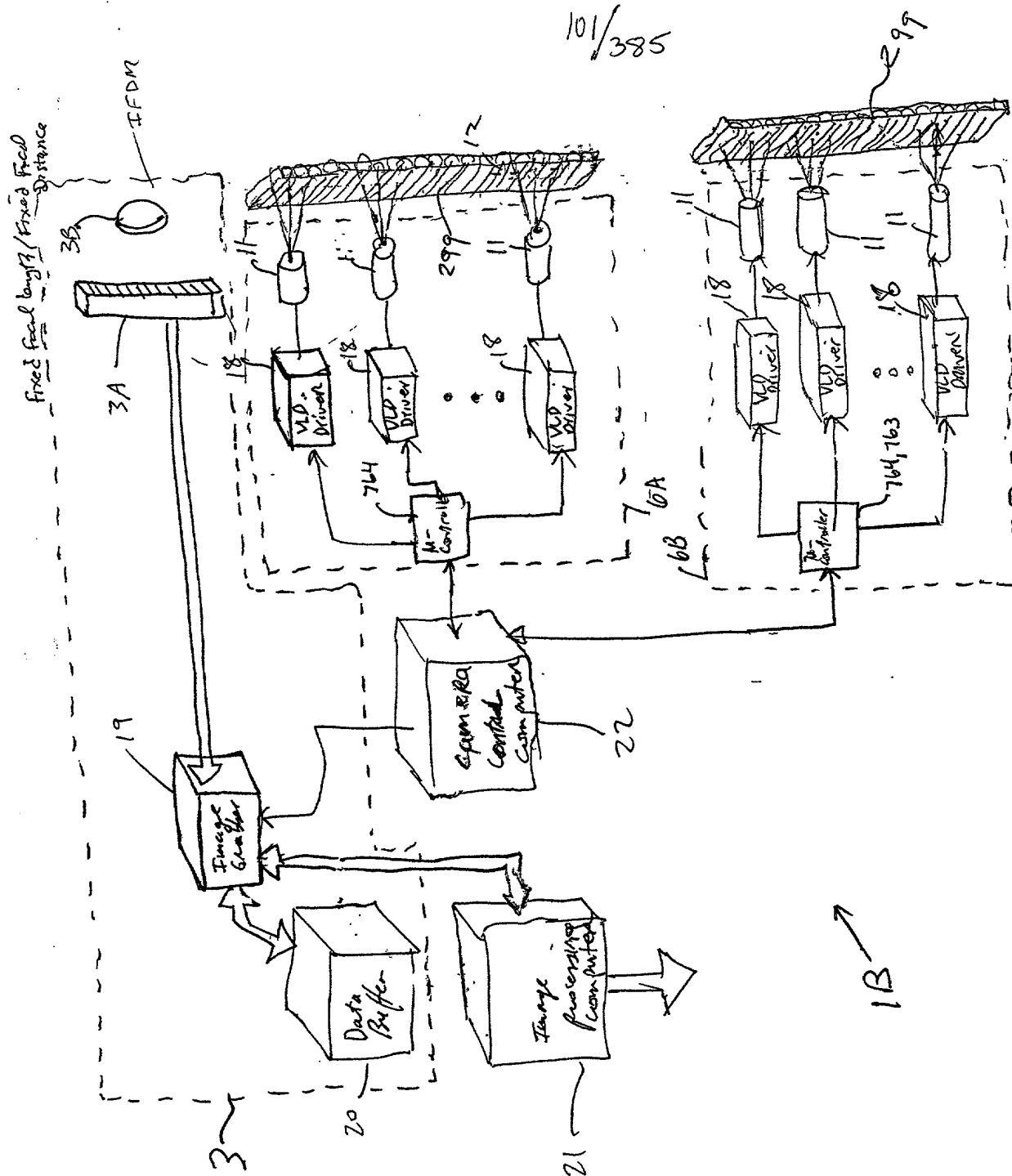
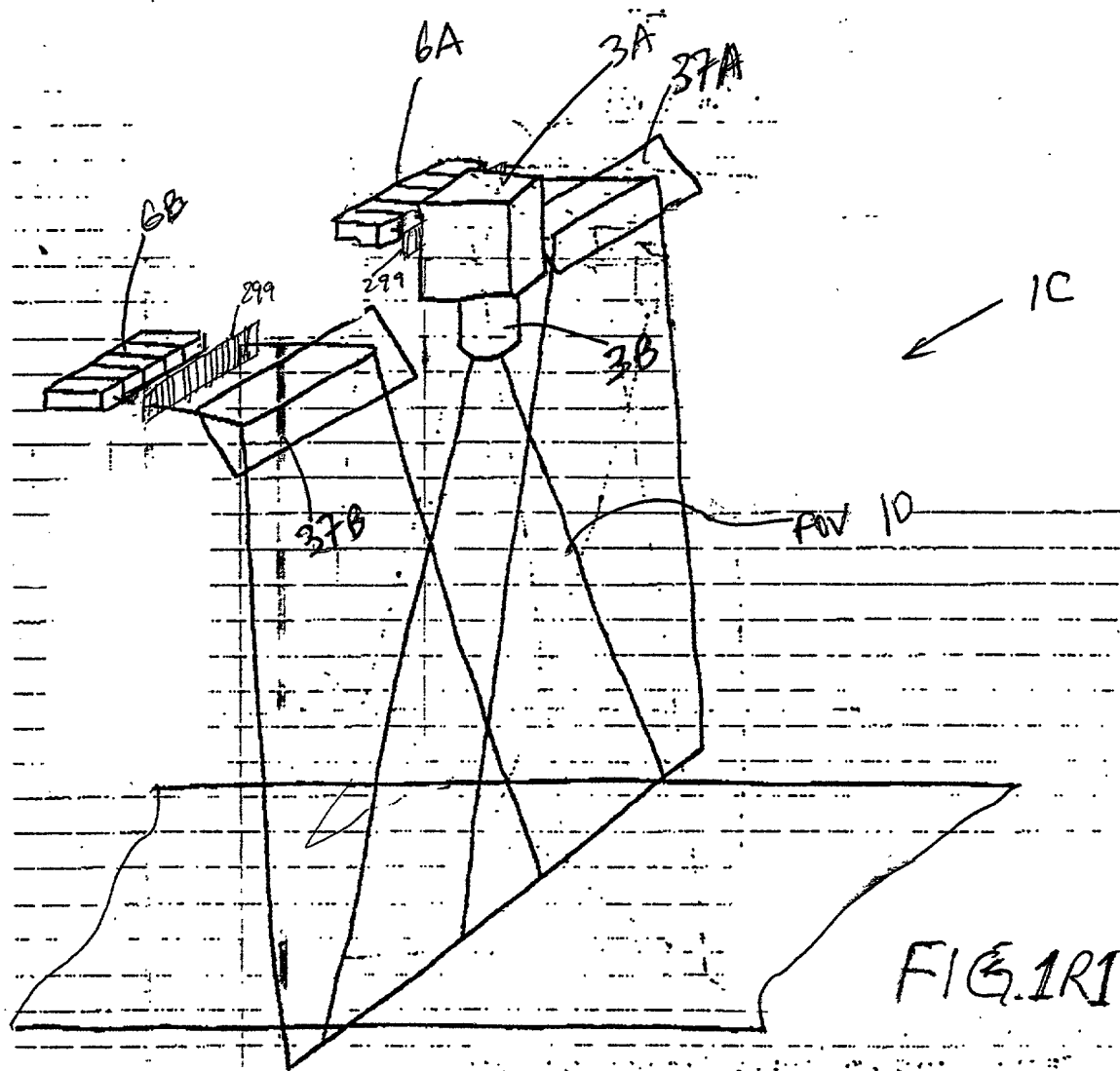


Fig. 102

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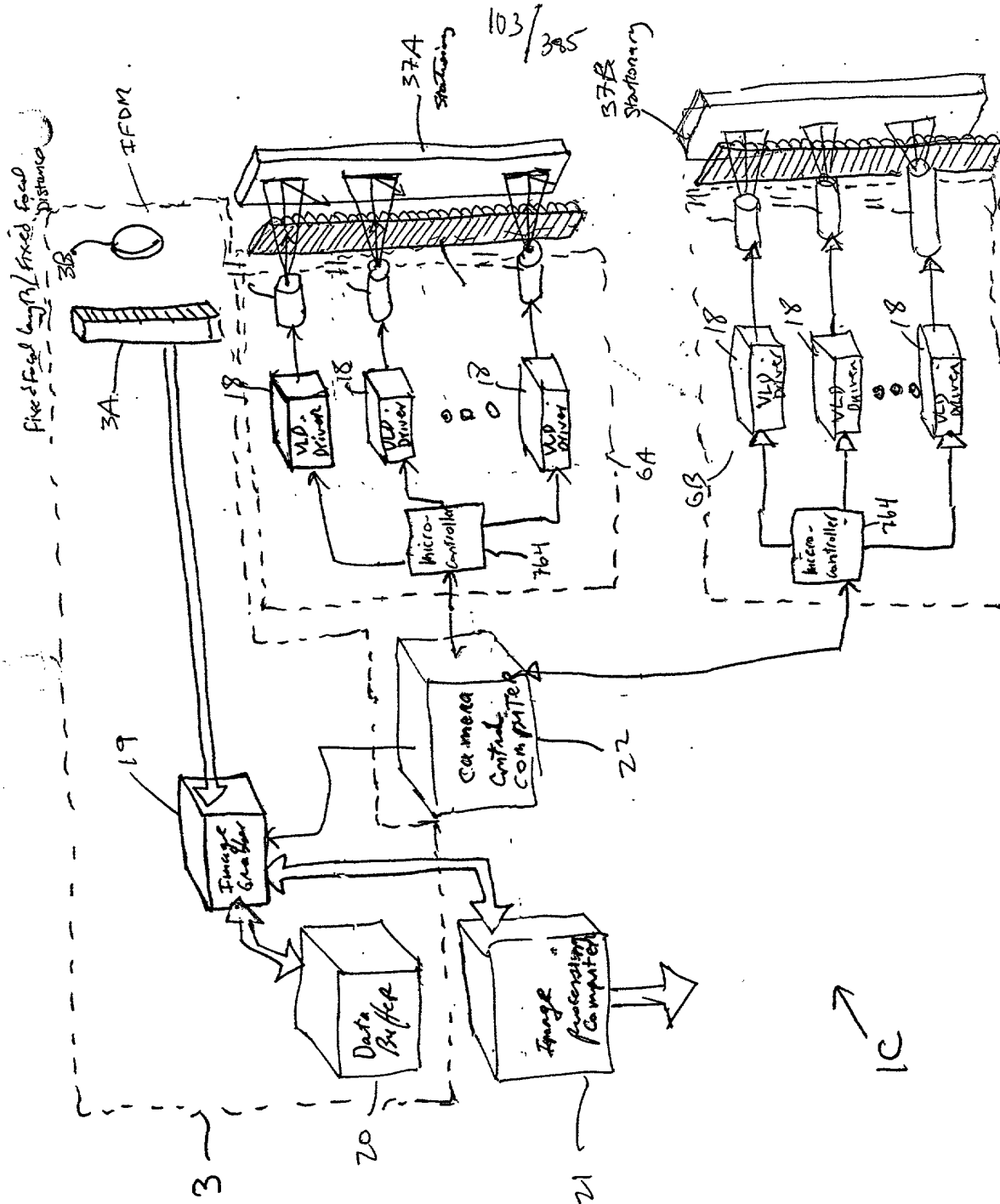


FIG. 1R2

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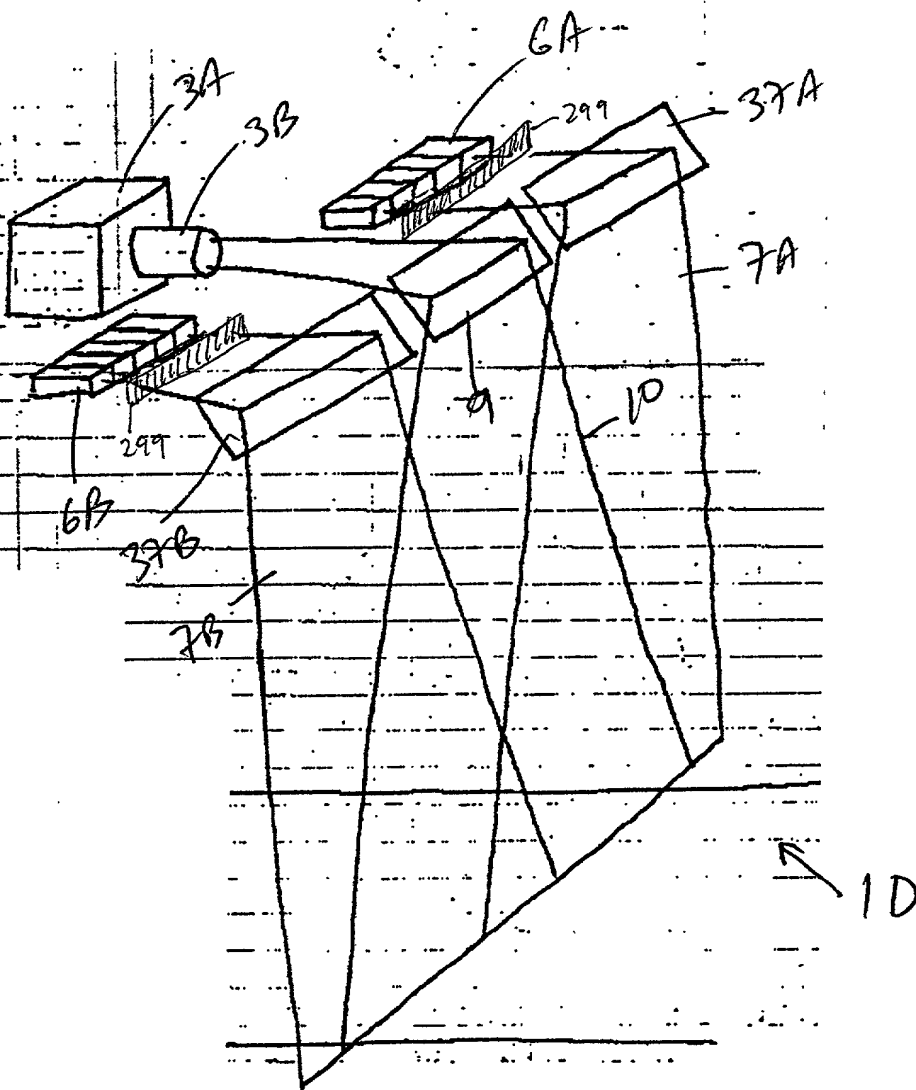


FIG. 1S1

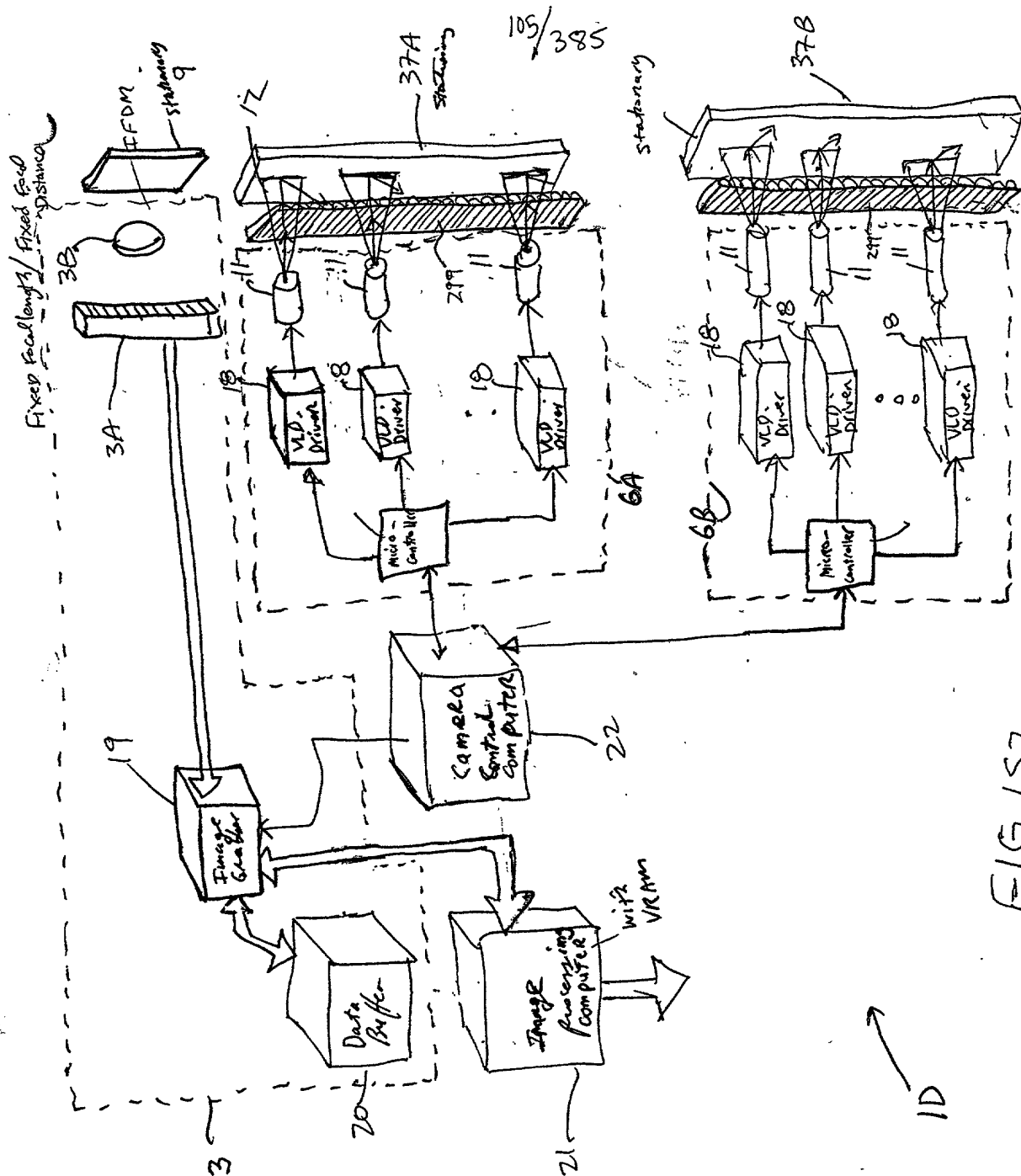


FIG. 1S2

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00000000 4444 00000000

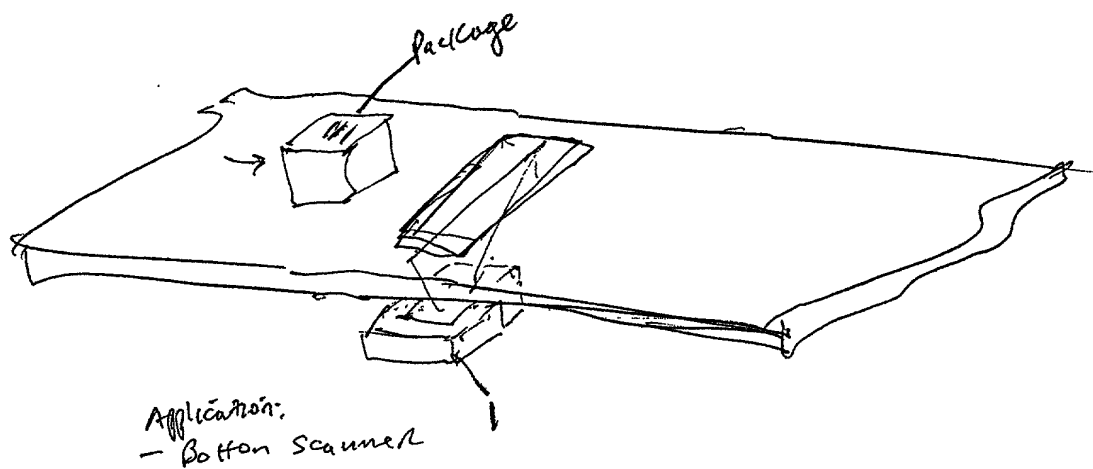


FIG 1T

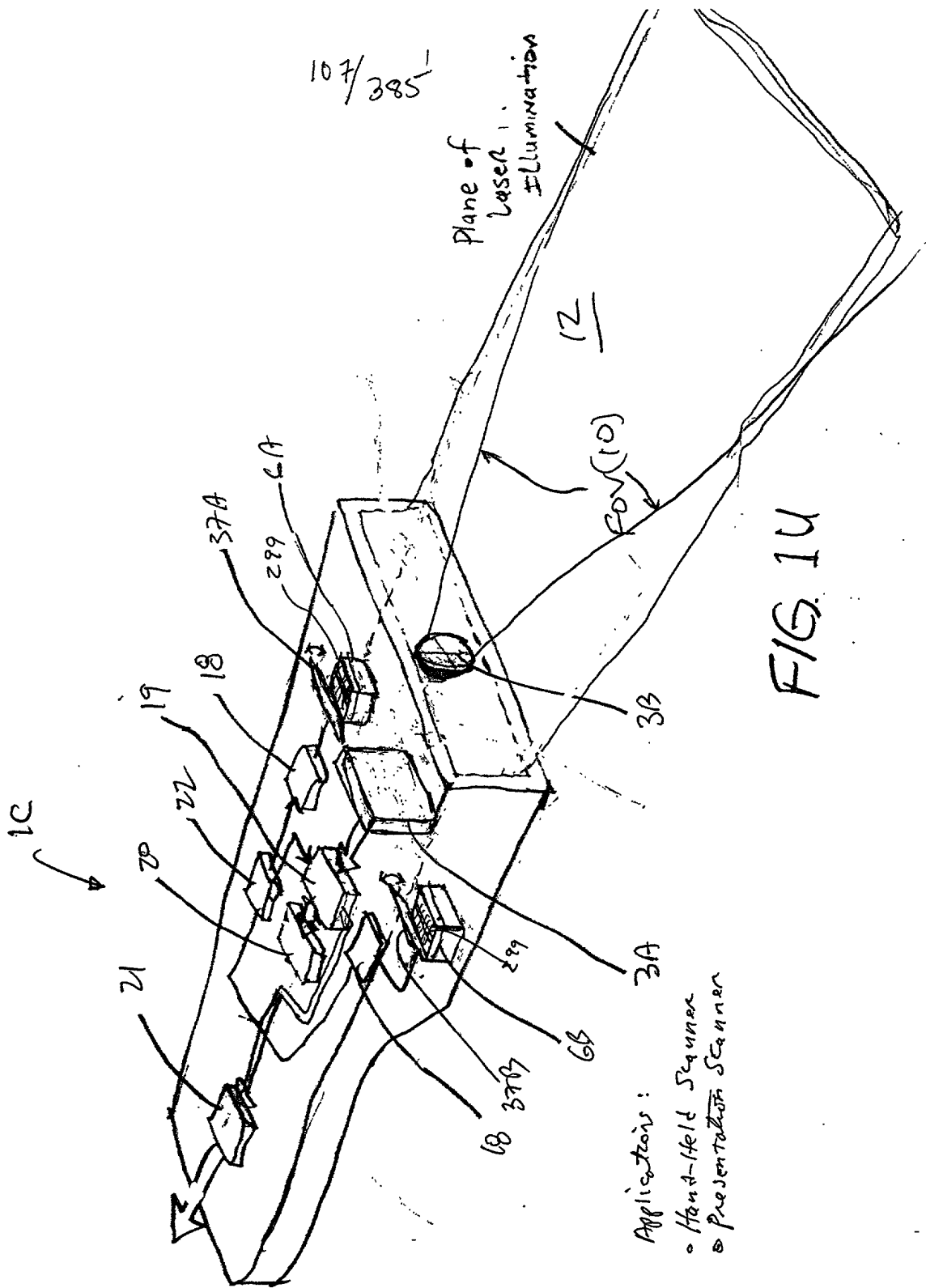


FIG. 1U

Applications:
 • Hand-Held Scanner
 • Presentation Scanner

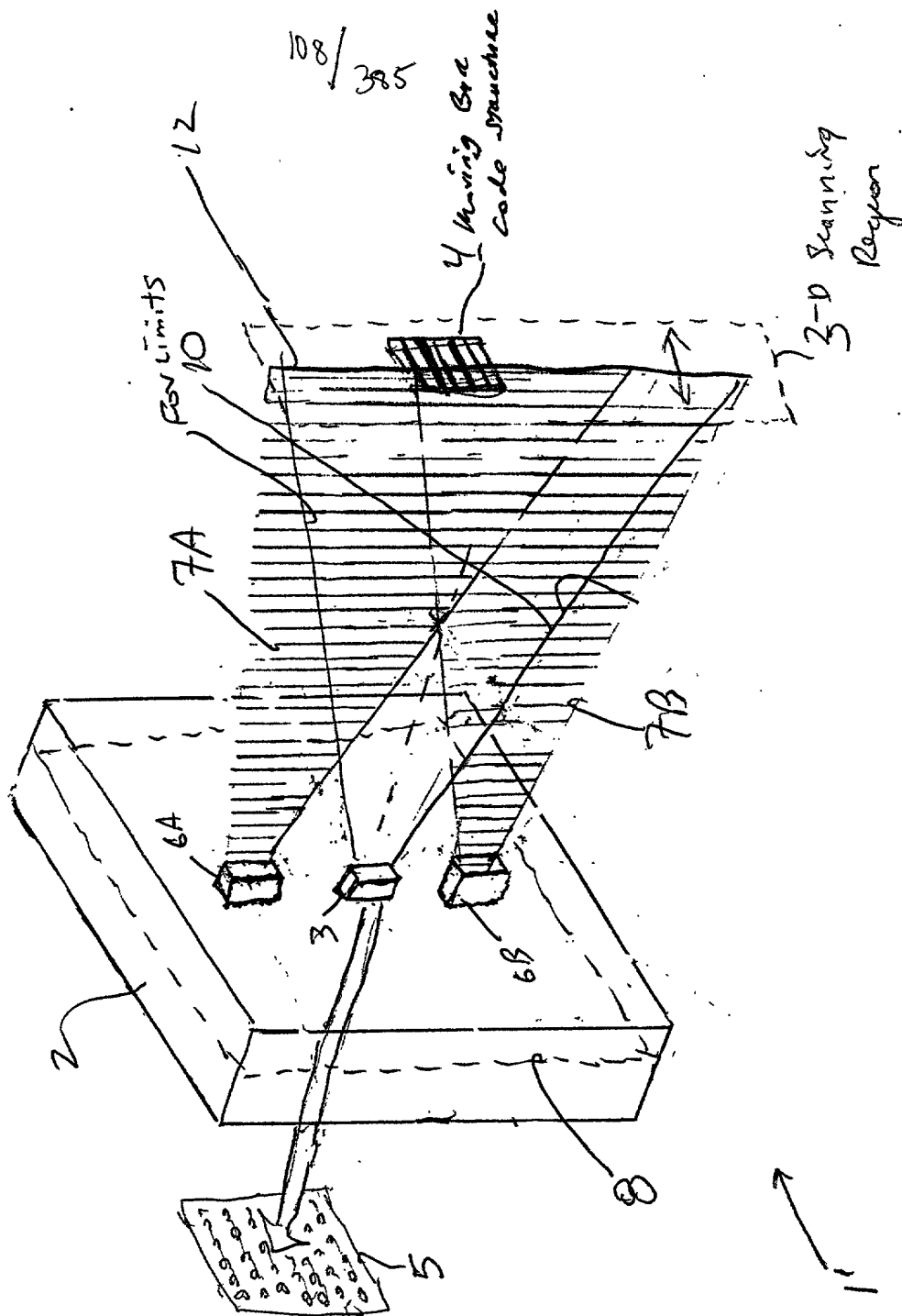


FIG. IVI

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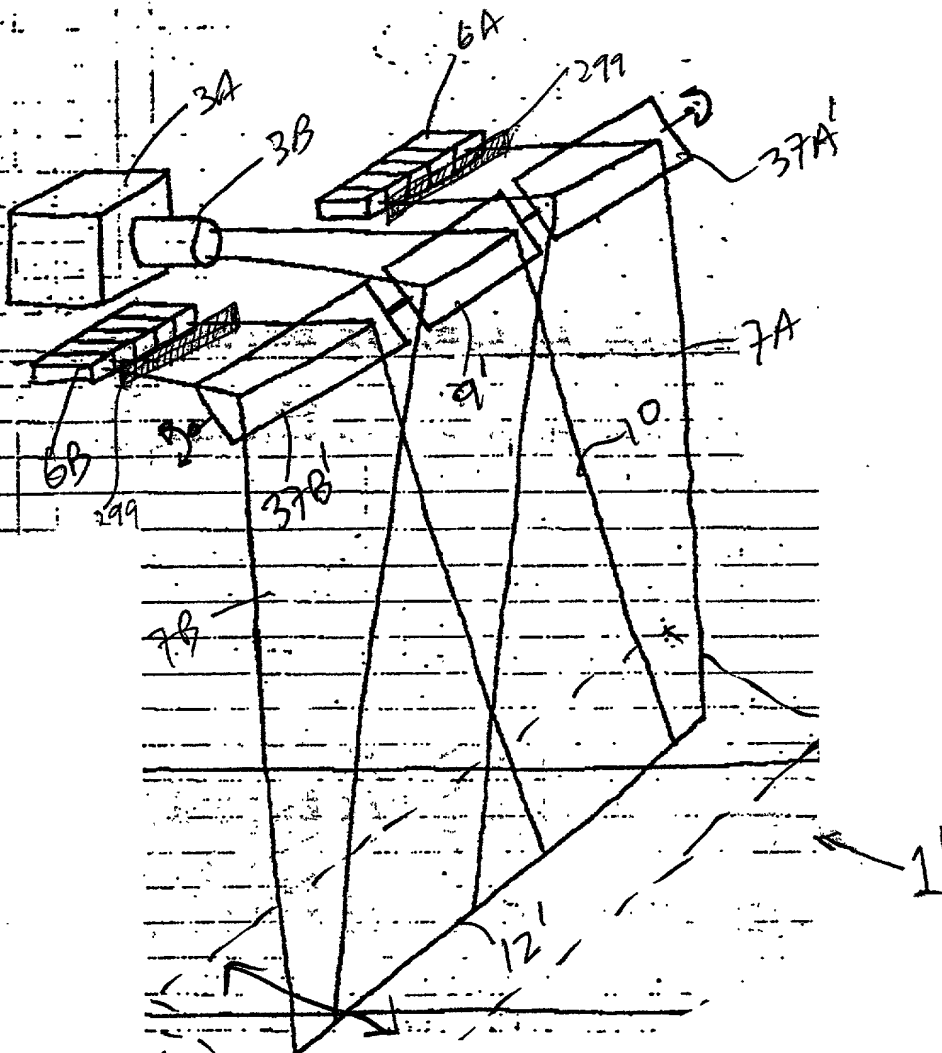
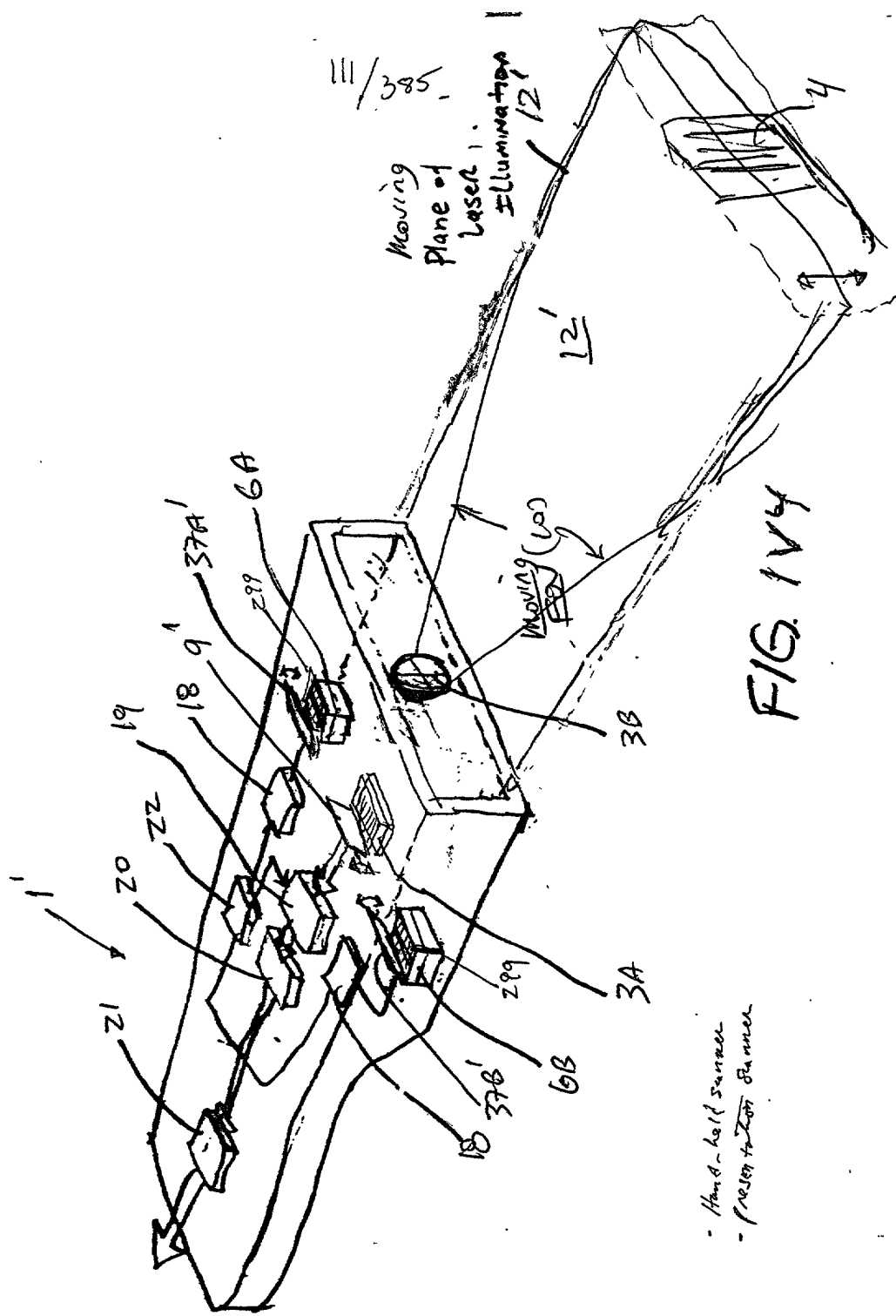


FIG. IV2

2-D
region
of
space

9

[illegible]

- Hand-held scanner
- Presentation Scanner

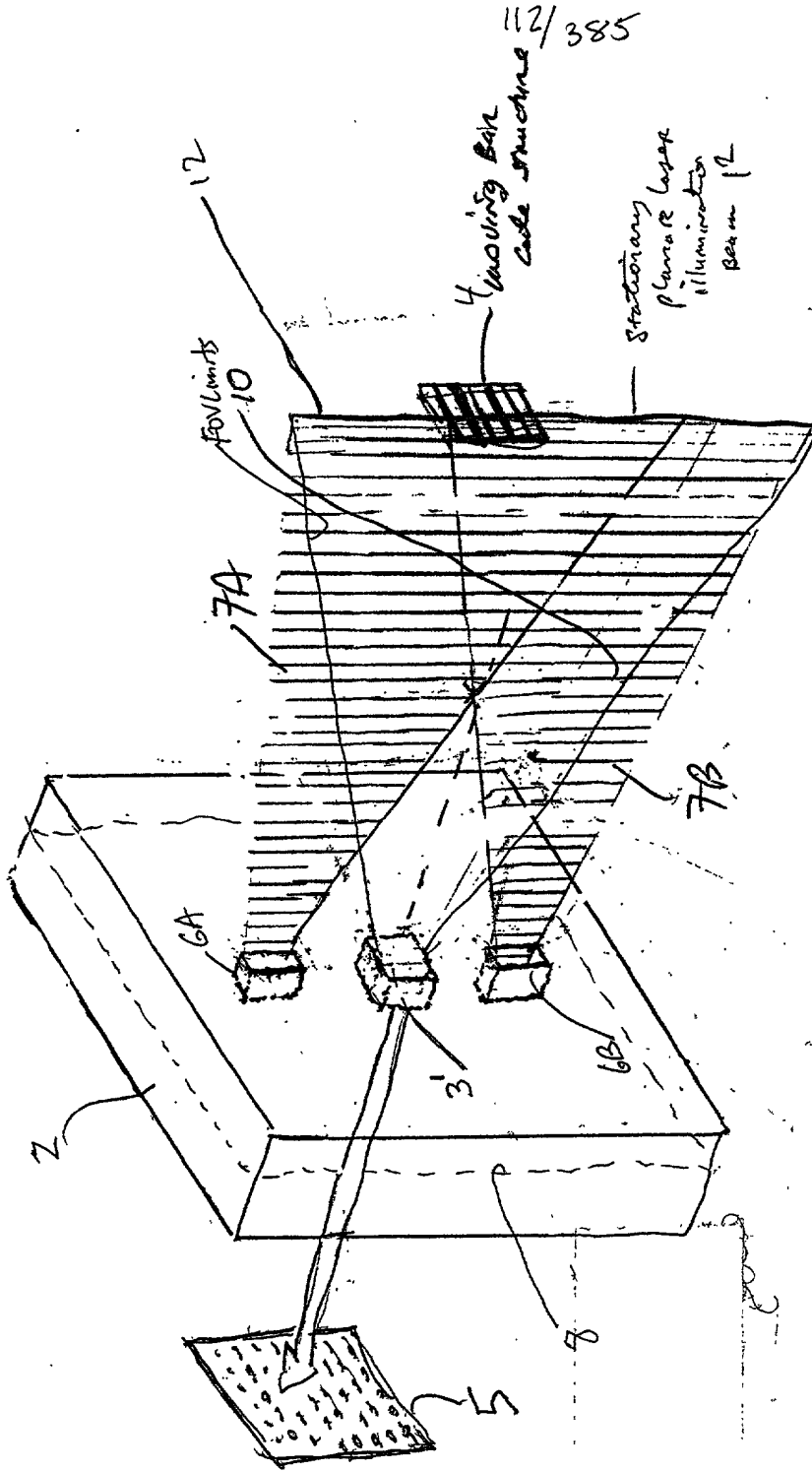


FIG. 2A

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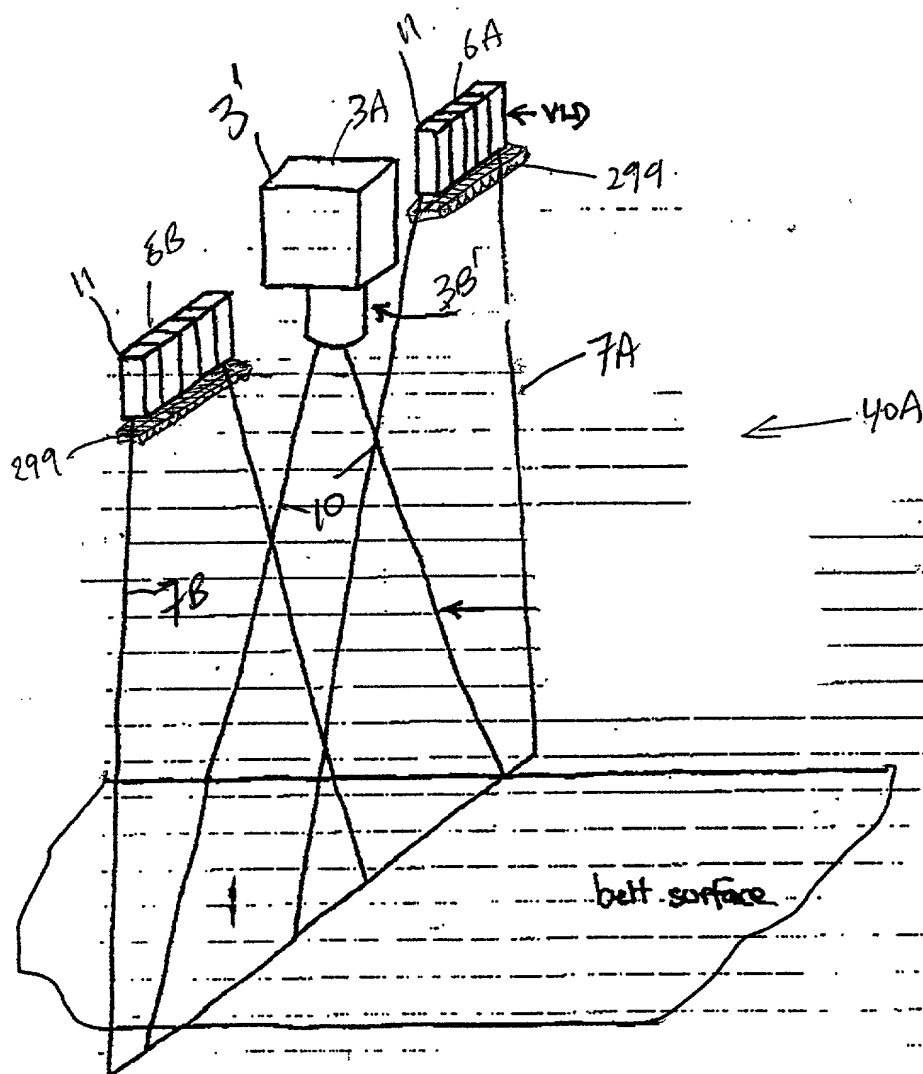


FIG. 2 B1

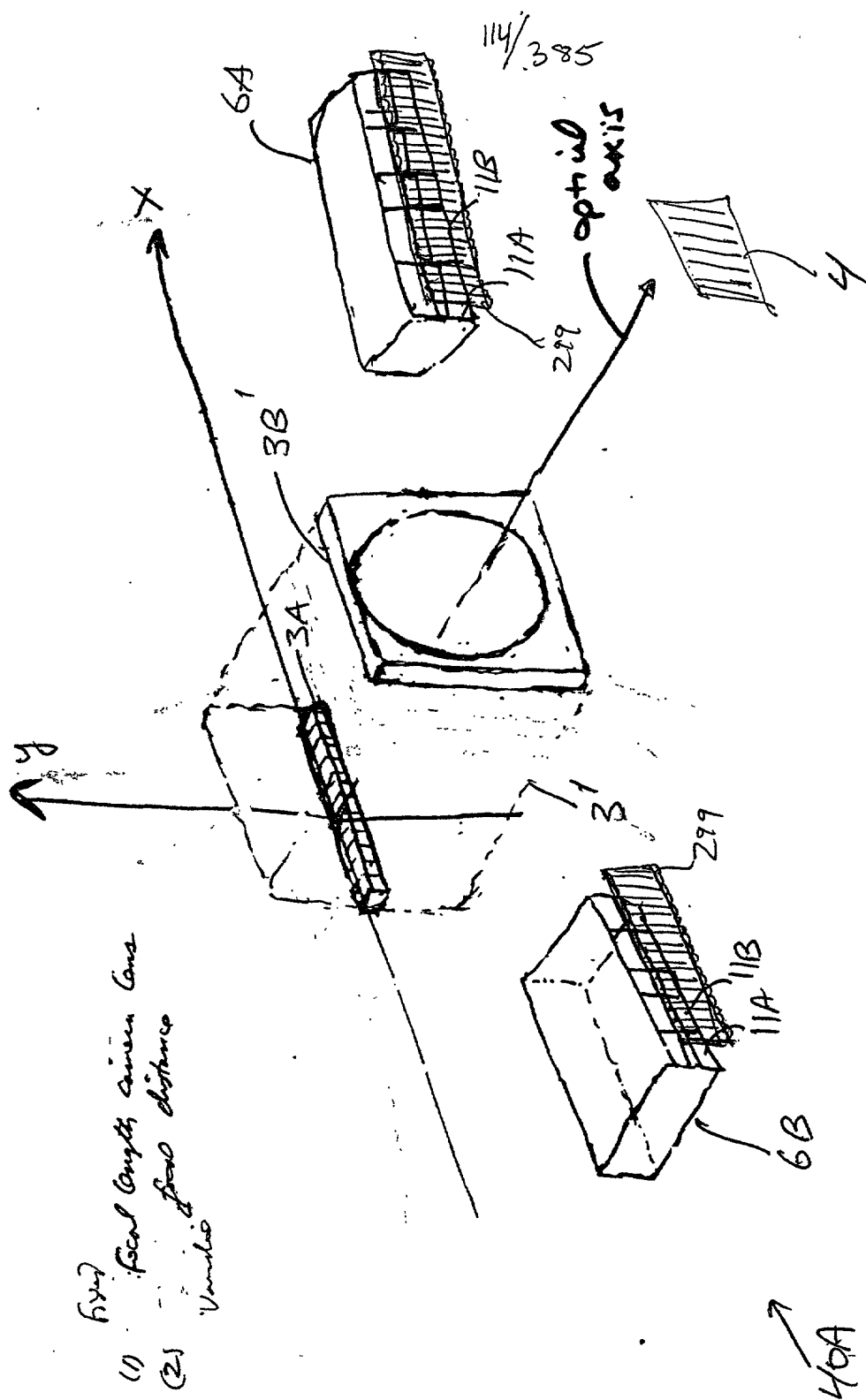


FIG. 2B2

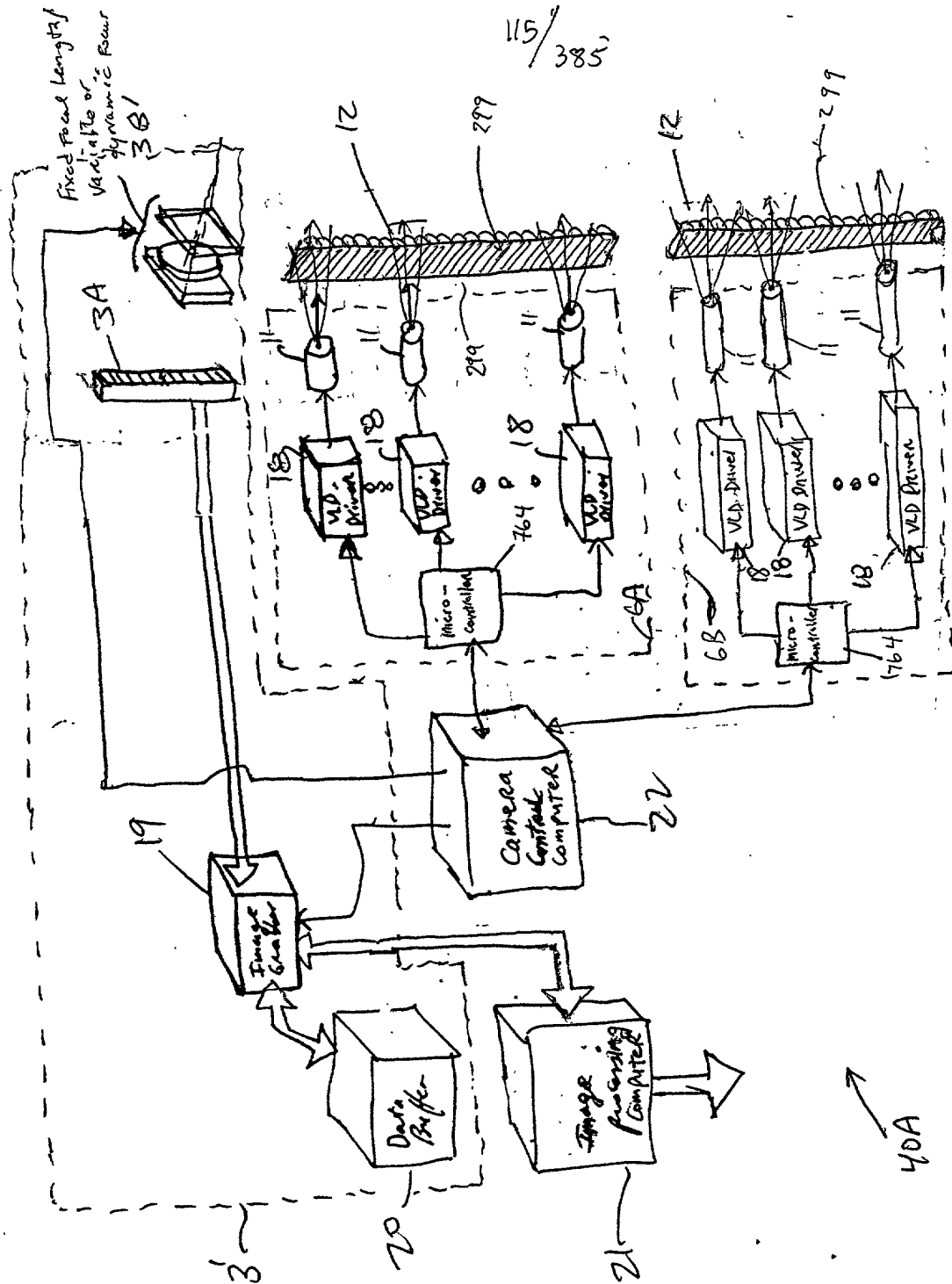


FIG. 2C1

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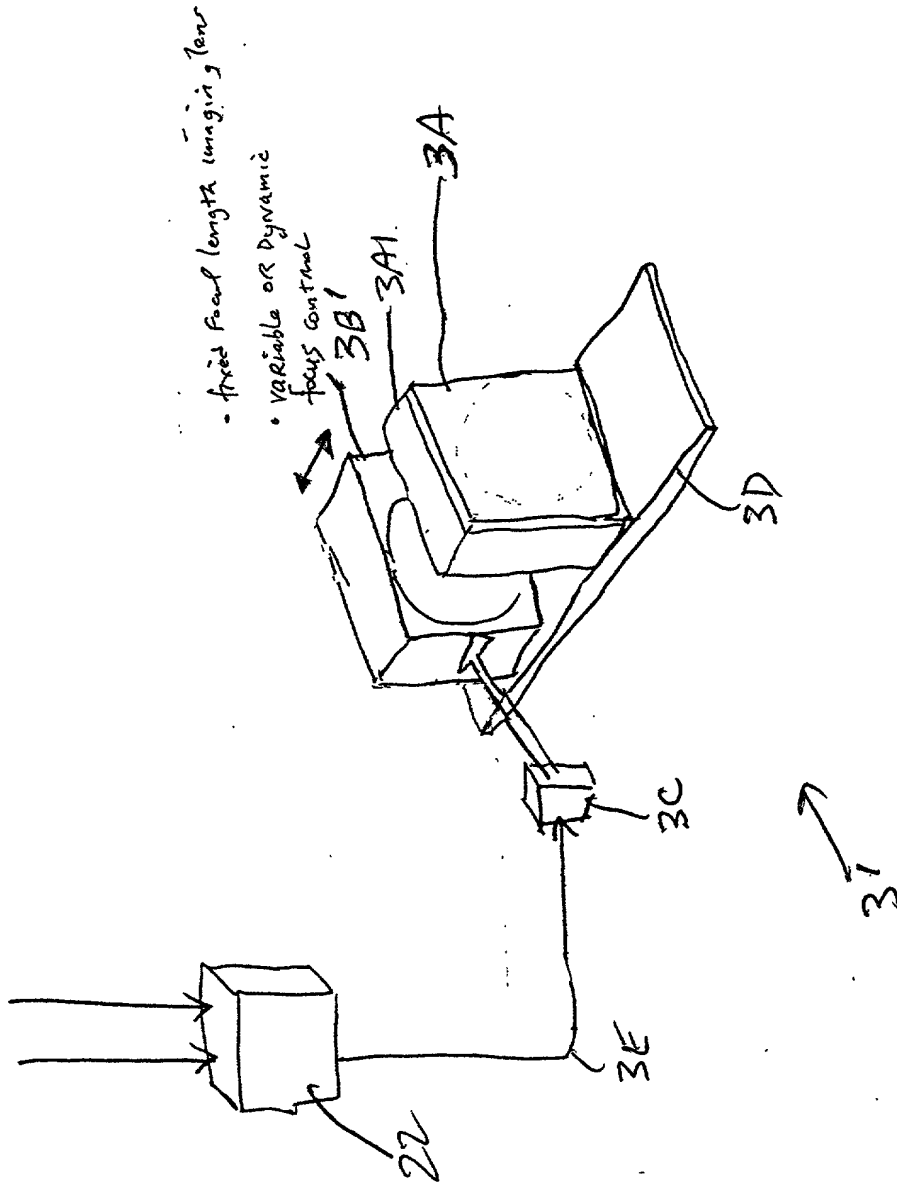


FIG. 2C2

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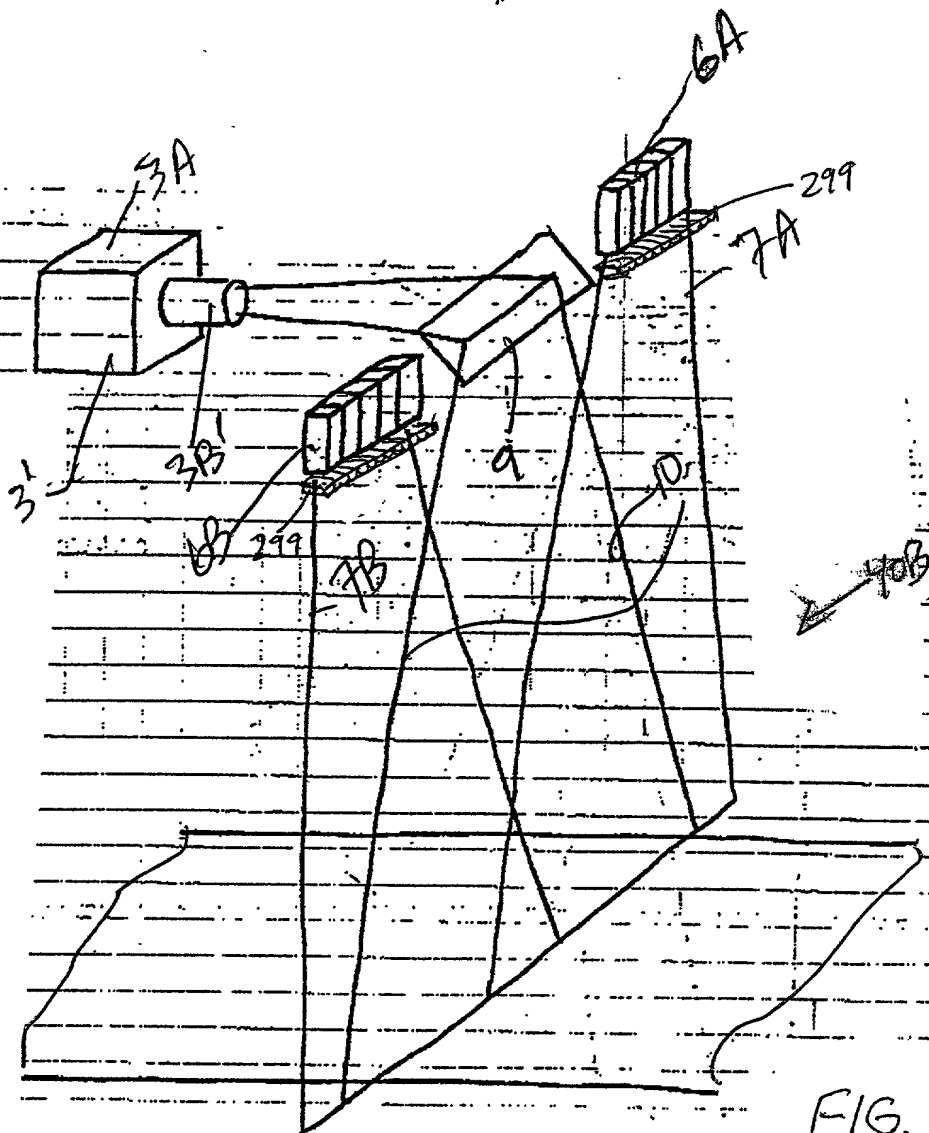


FIG. 2D1

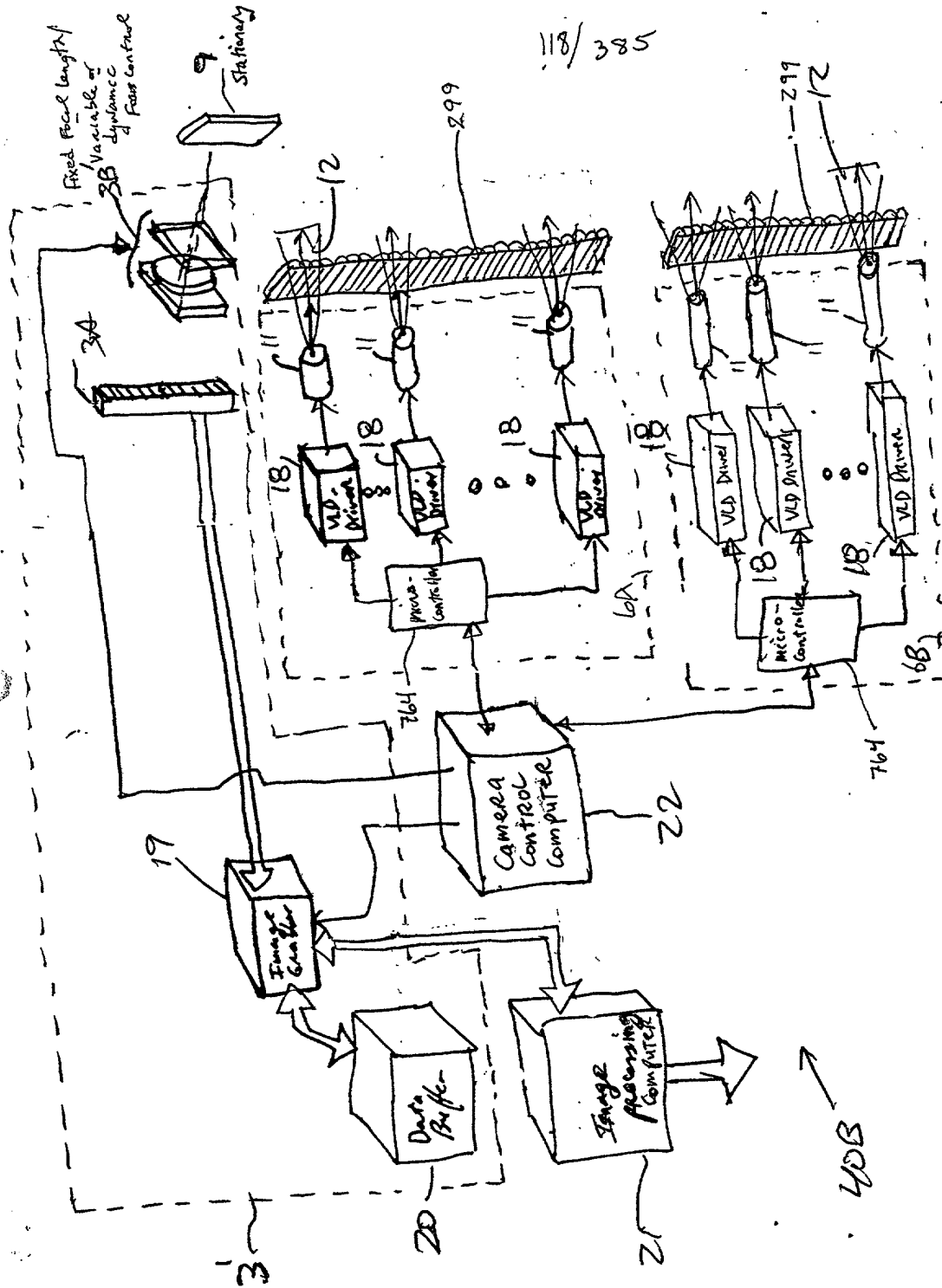
[illegible]

FIG. 2D2

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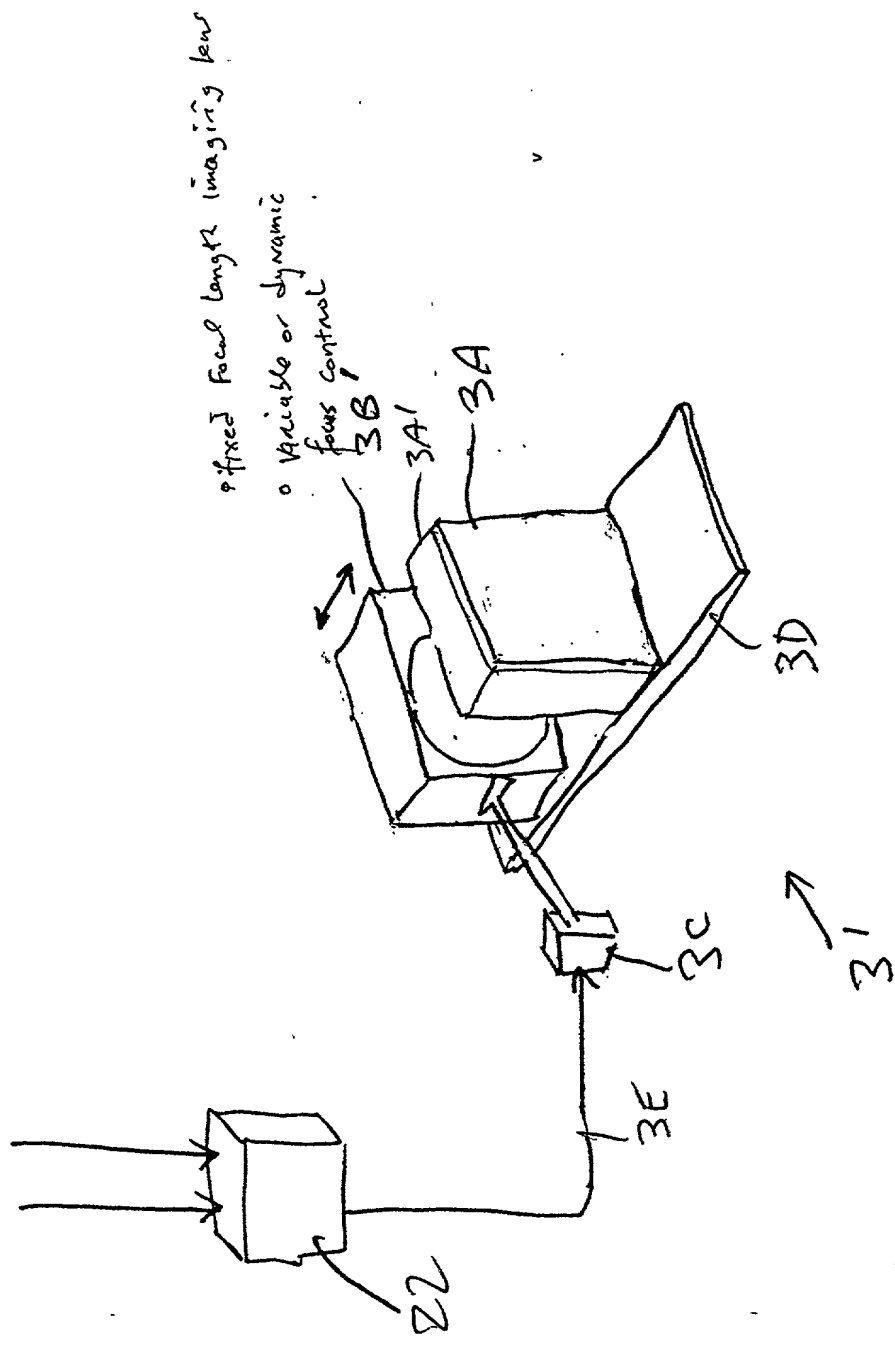
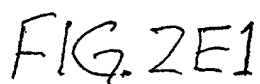


FIG. 2D3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
2	2	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
3	3	2	1	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
4	4	3	2	1	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
5	5	4	3	2	1	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80																				



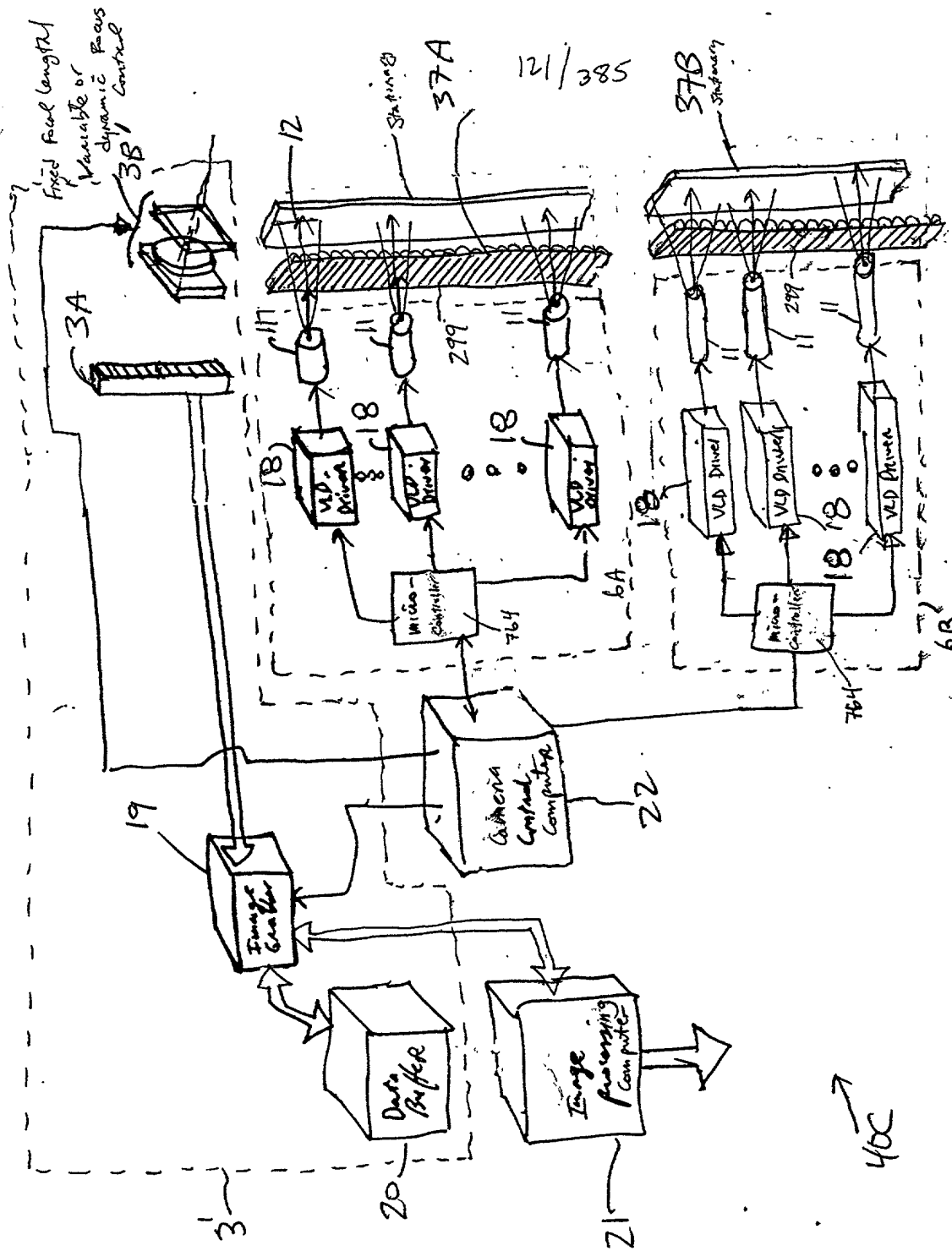


FIG. 2E2

TOP SECRET 98506560

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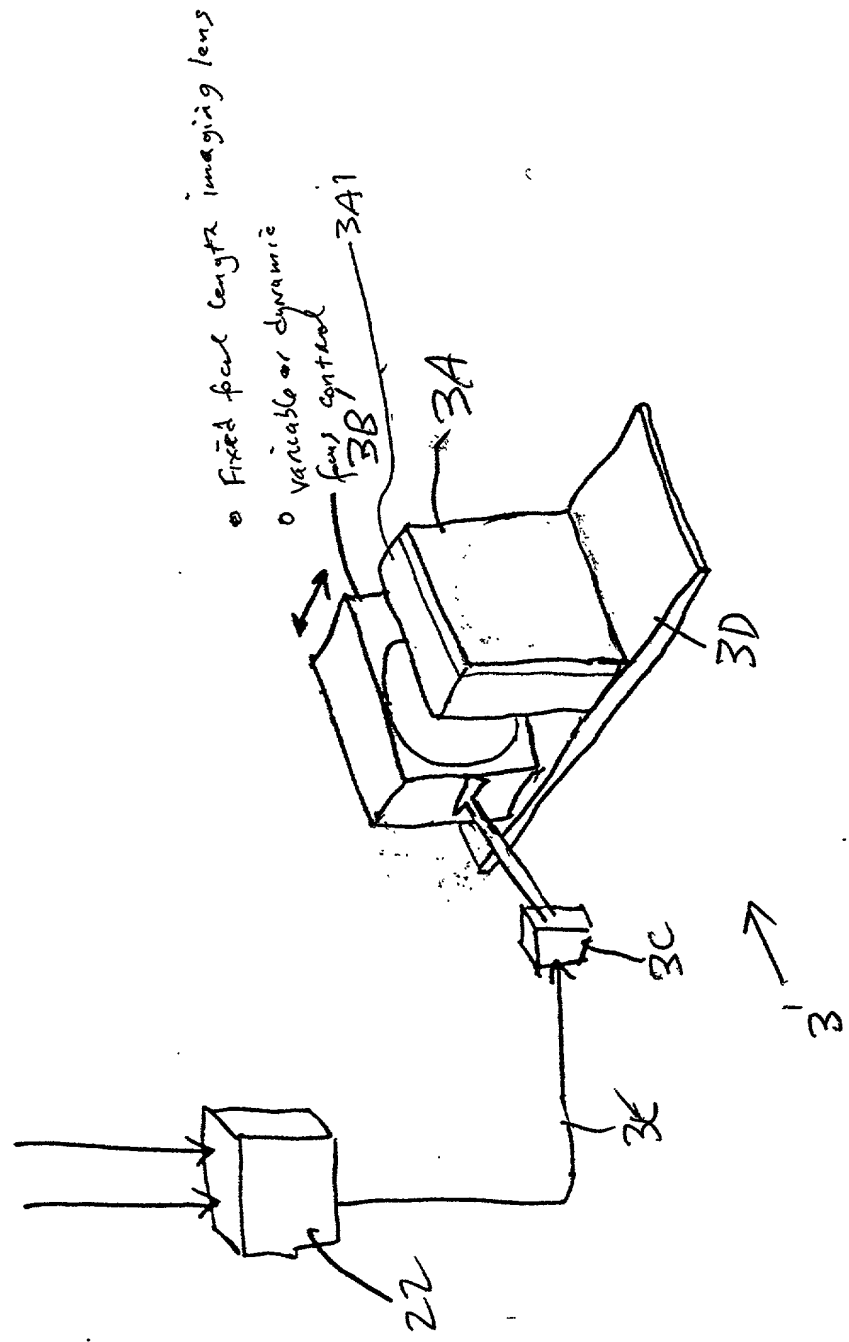


FIG. 2E3

FIG. 2F1

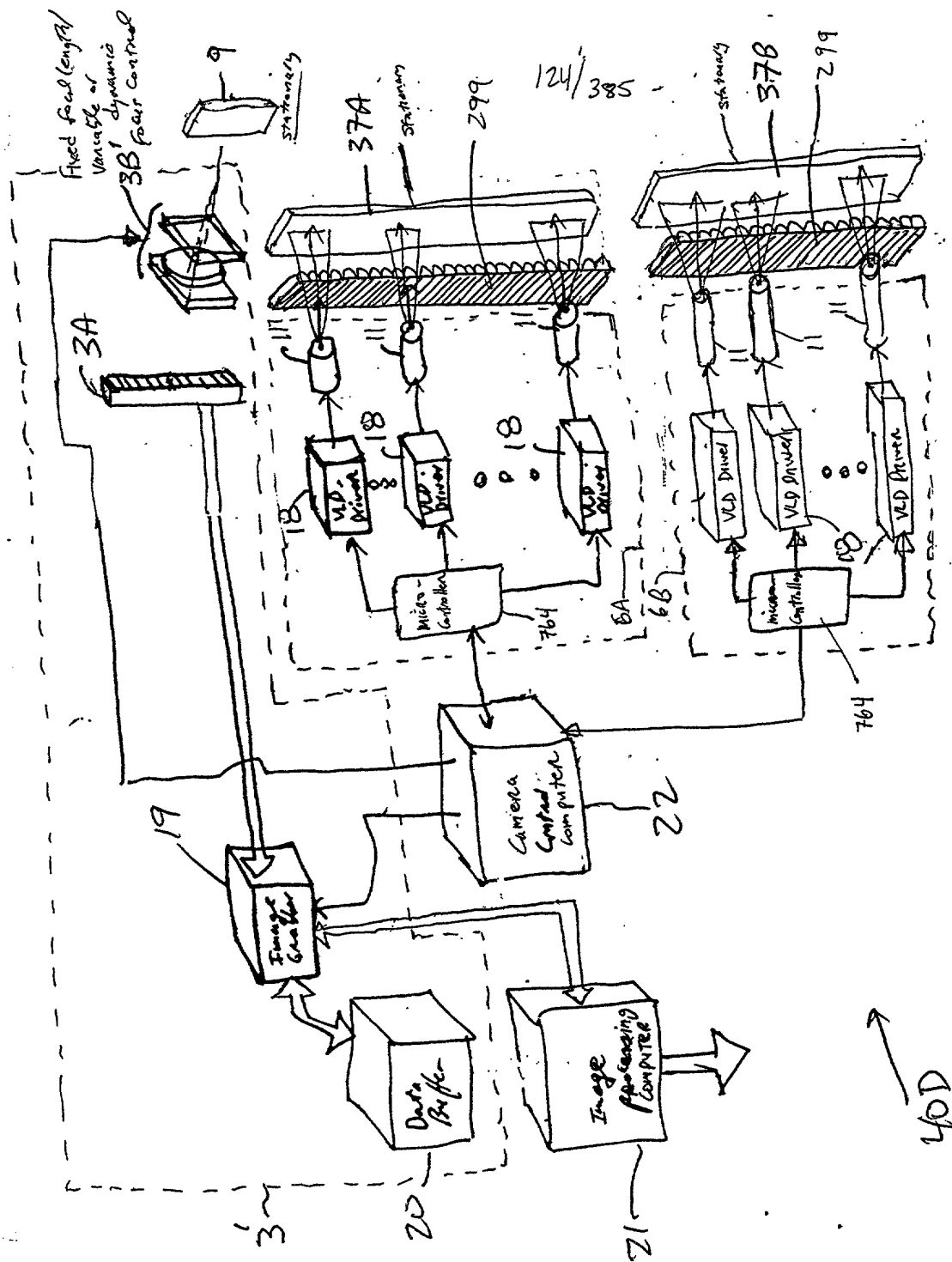


FIG 2FZ

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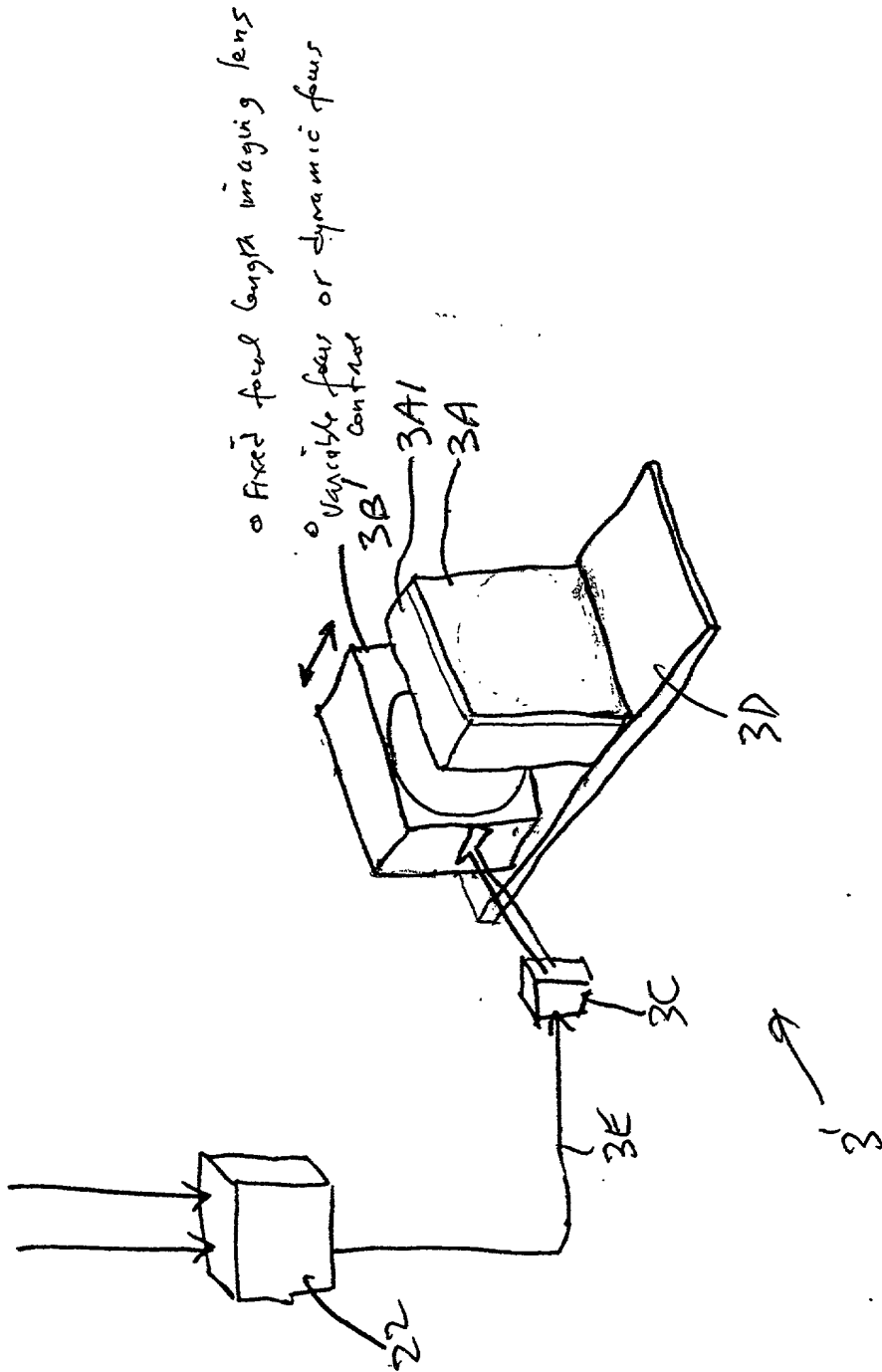


FIG. 2F3

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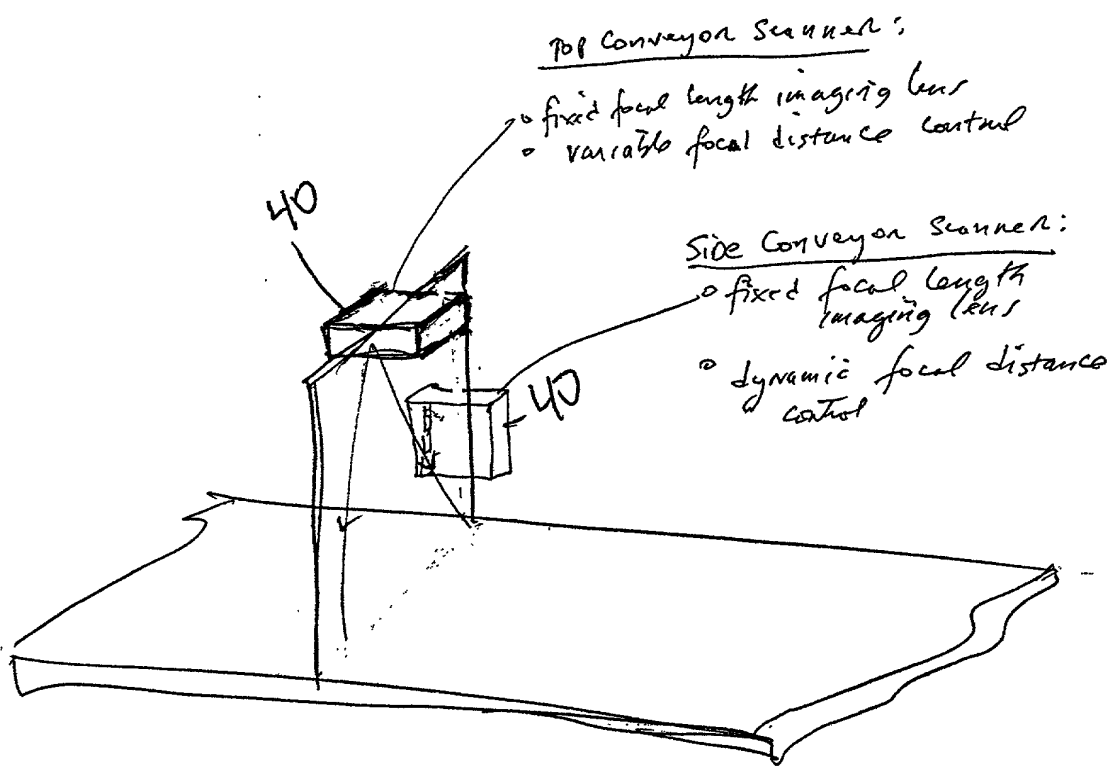
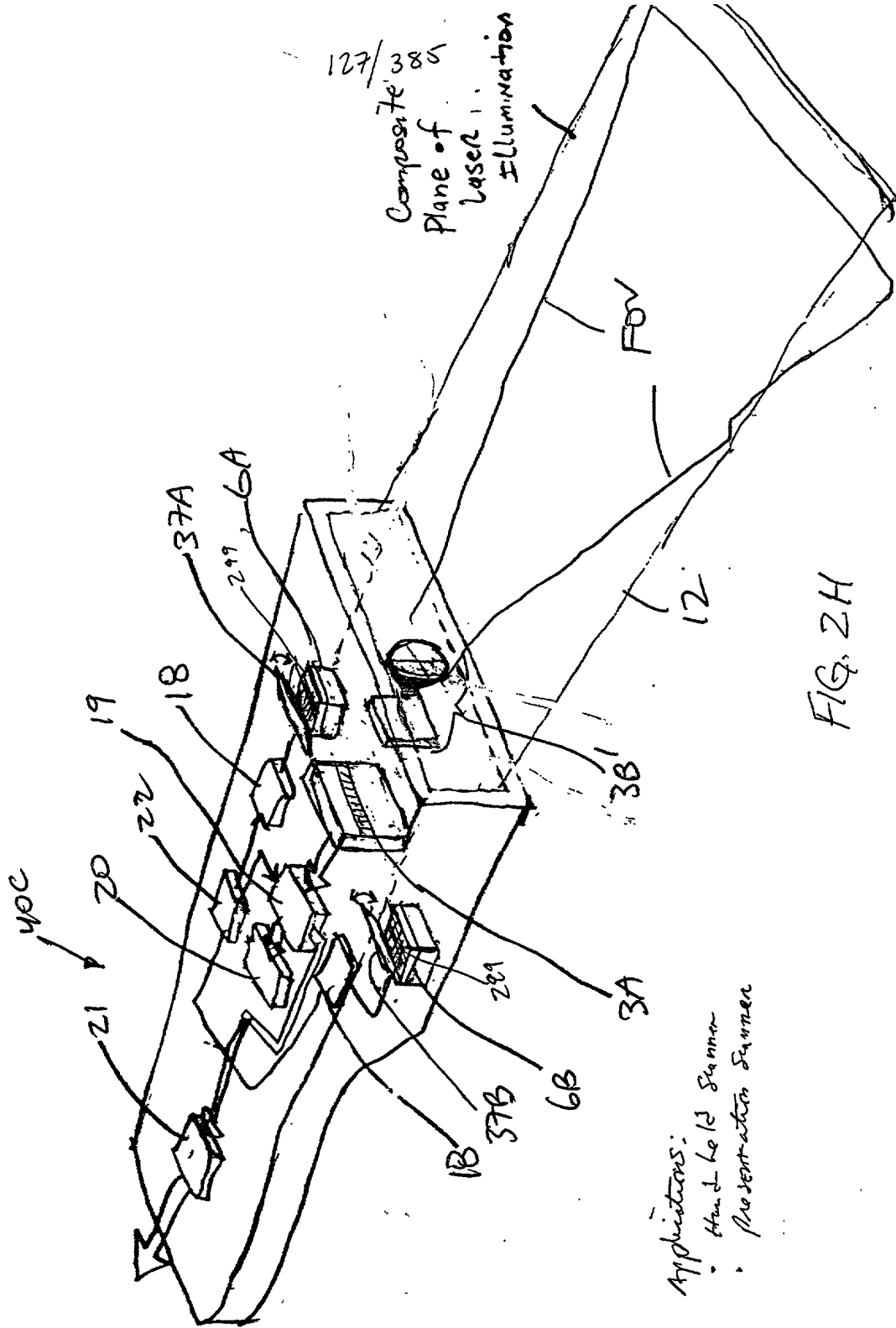


FIG. 2G



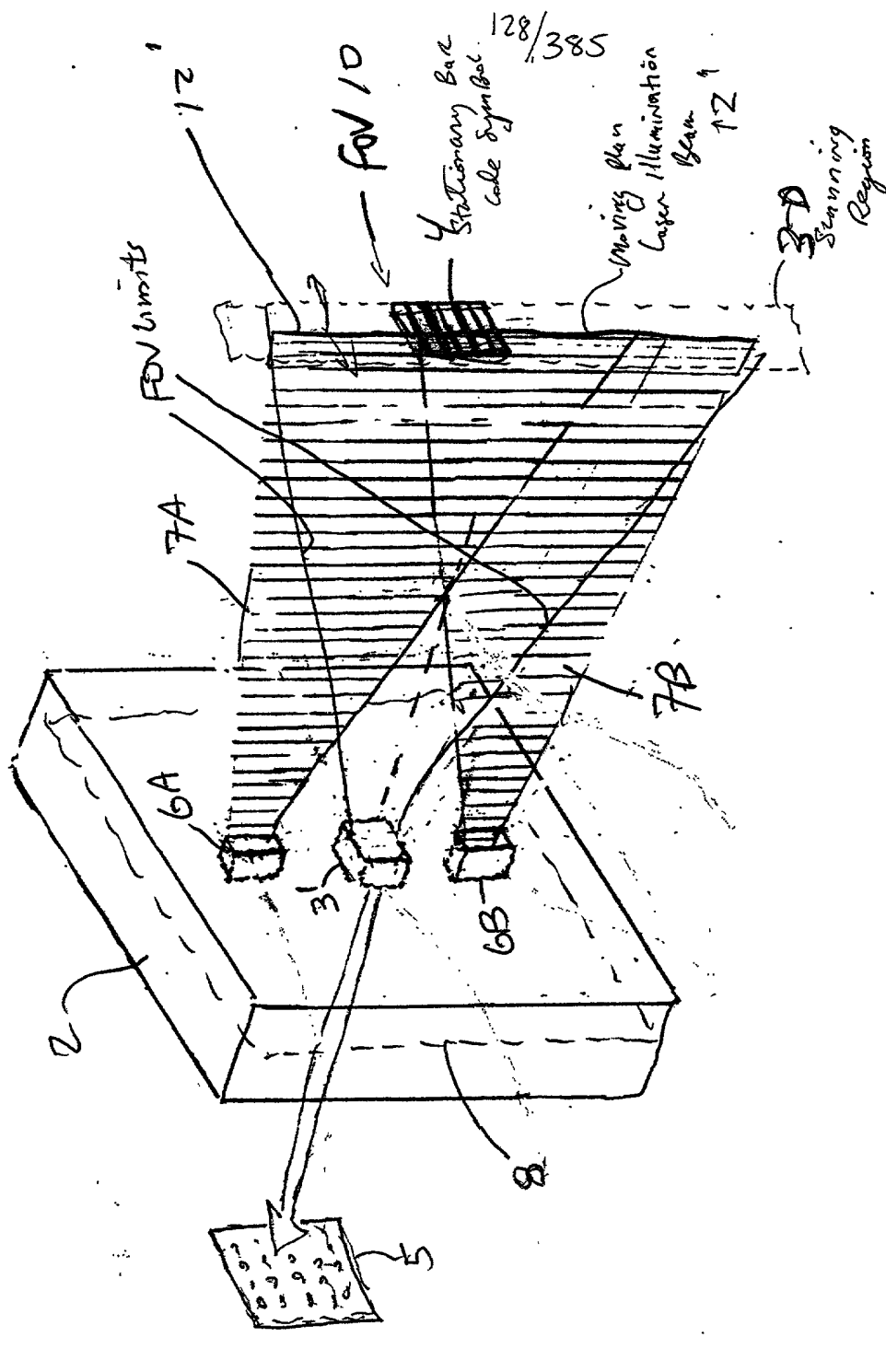
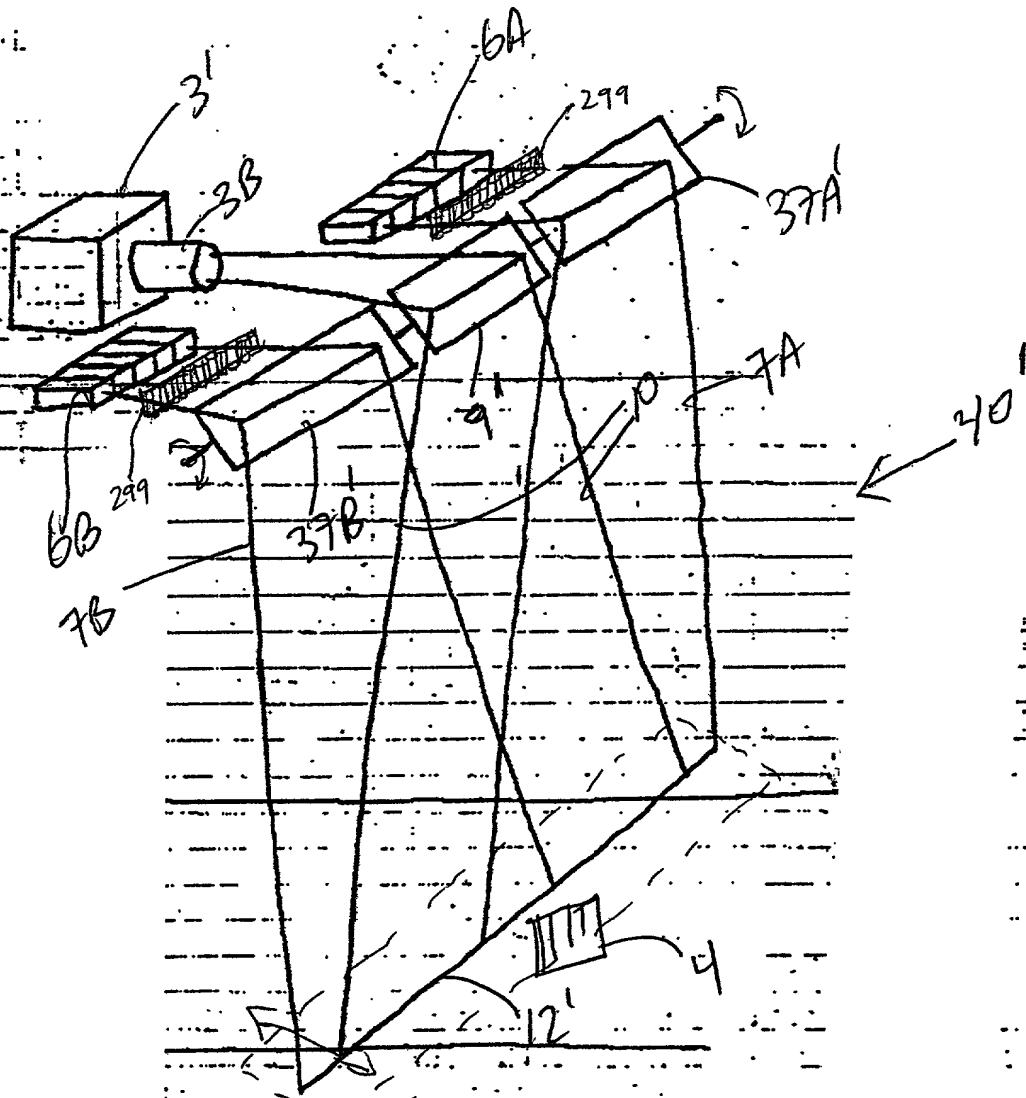


FIG. 2II

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3-D
Scanning
Region

FIG 2I2

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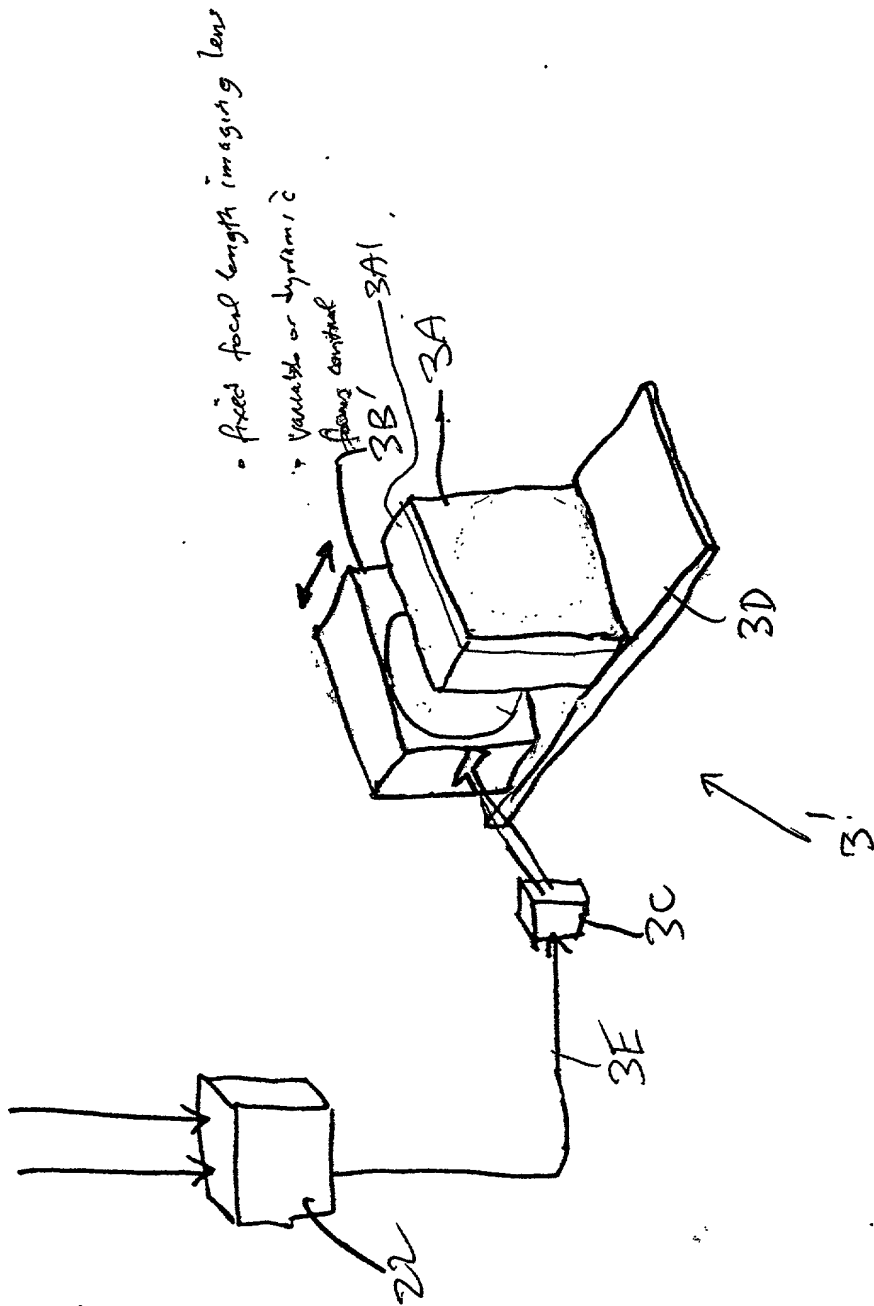


FIG. 2I4

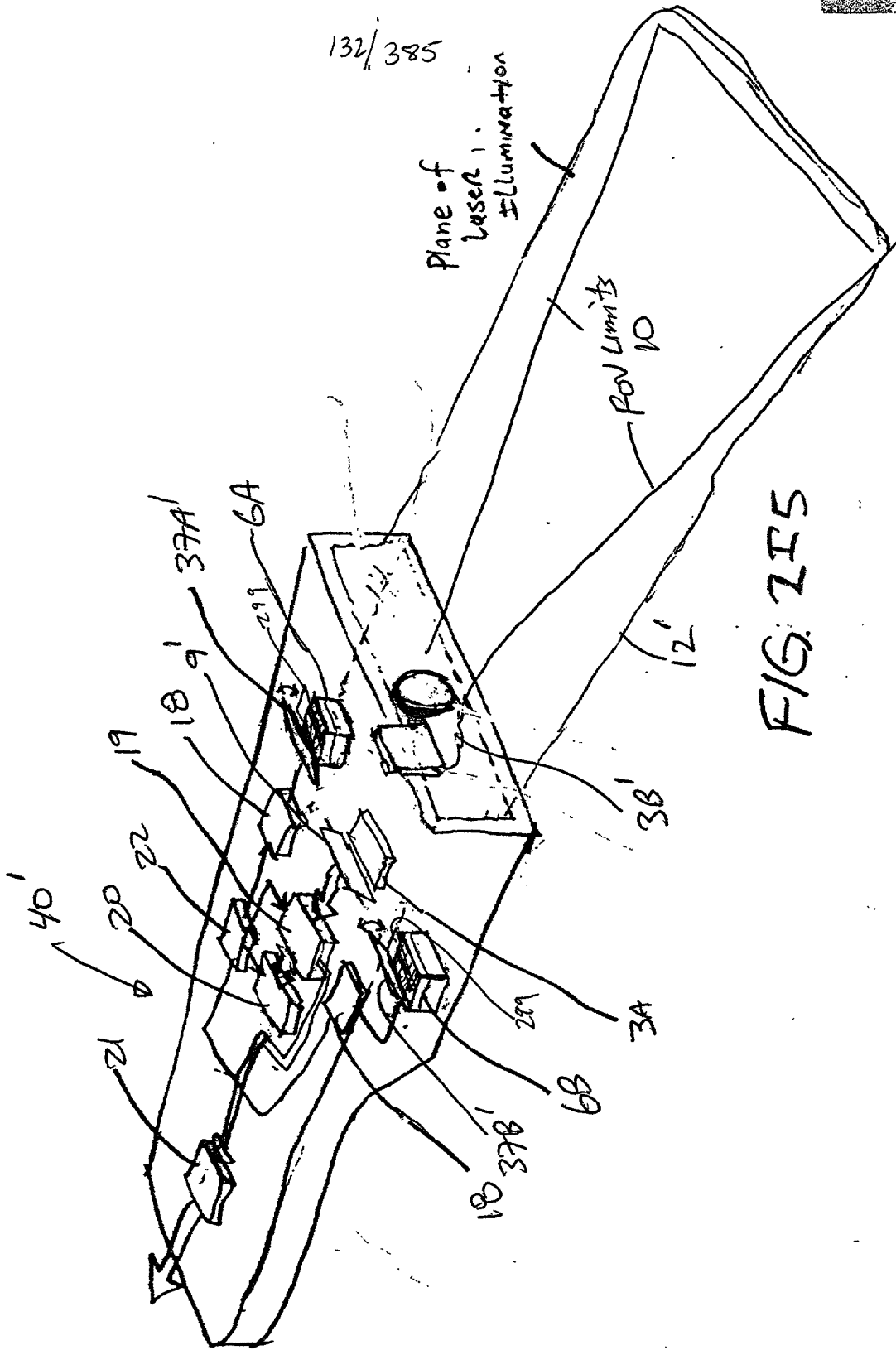


FIG. 215

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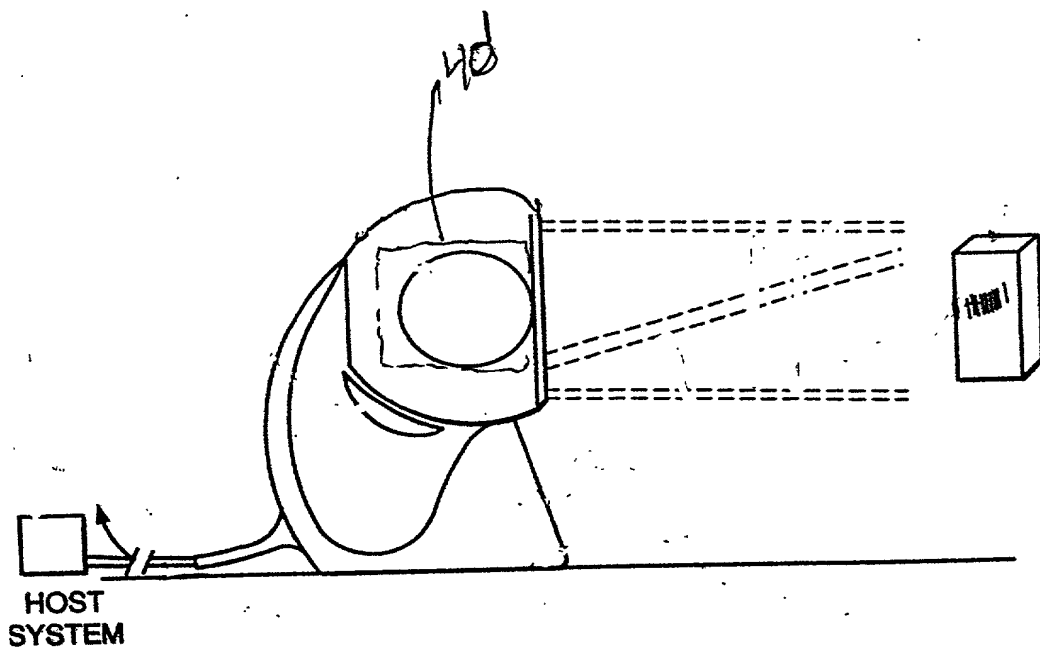


FIG. 2I6

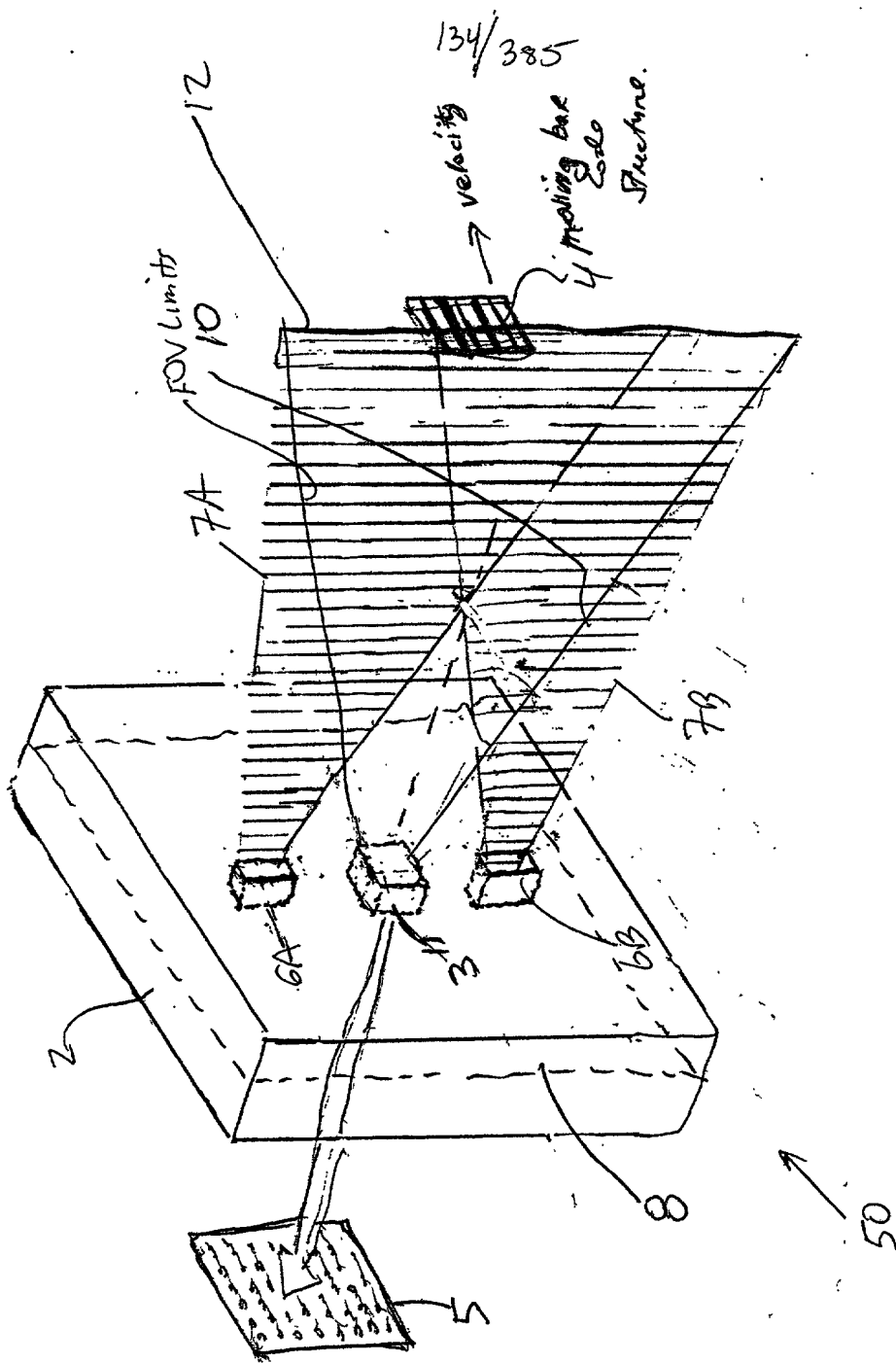


FIG 3A

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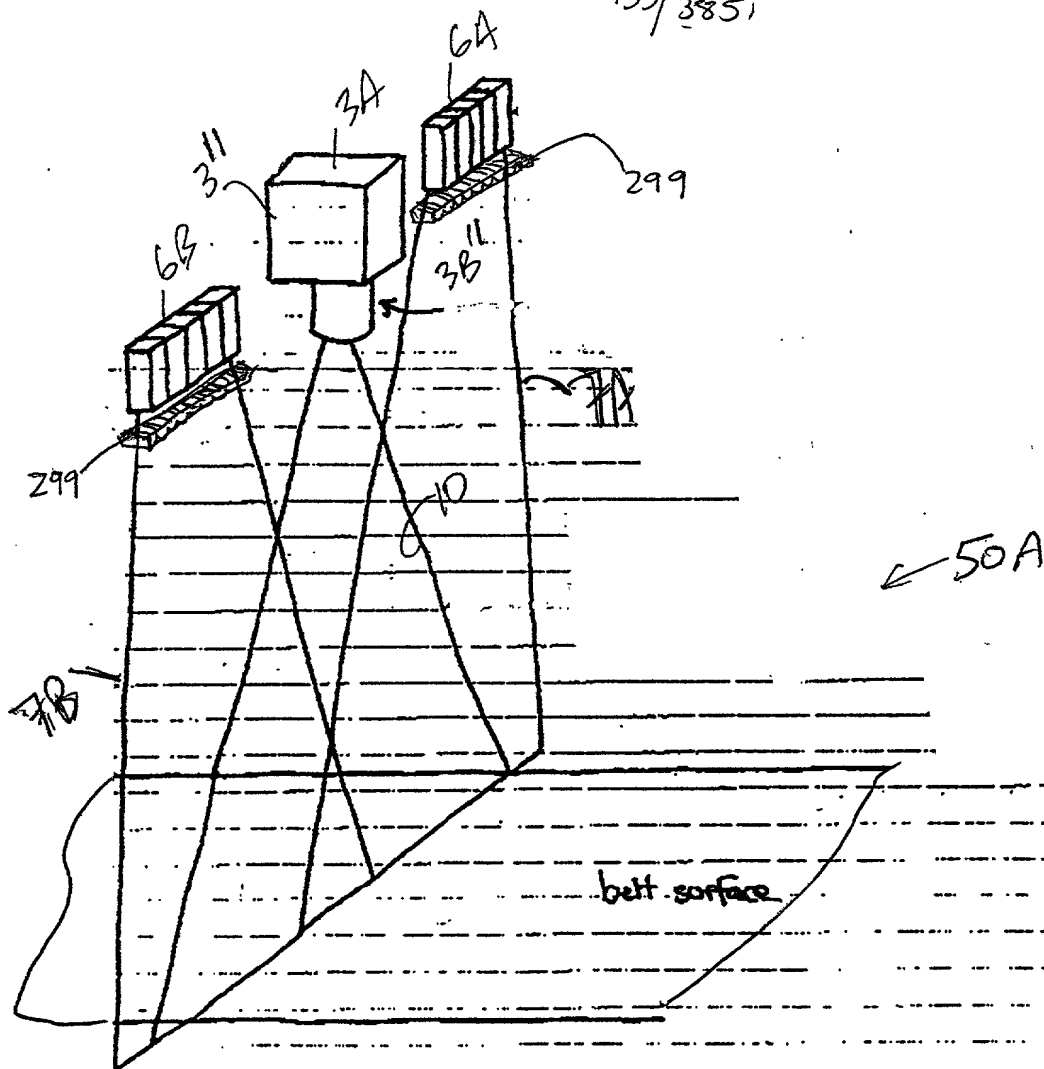


FIG. 3B1

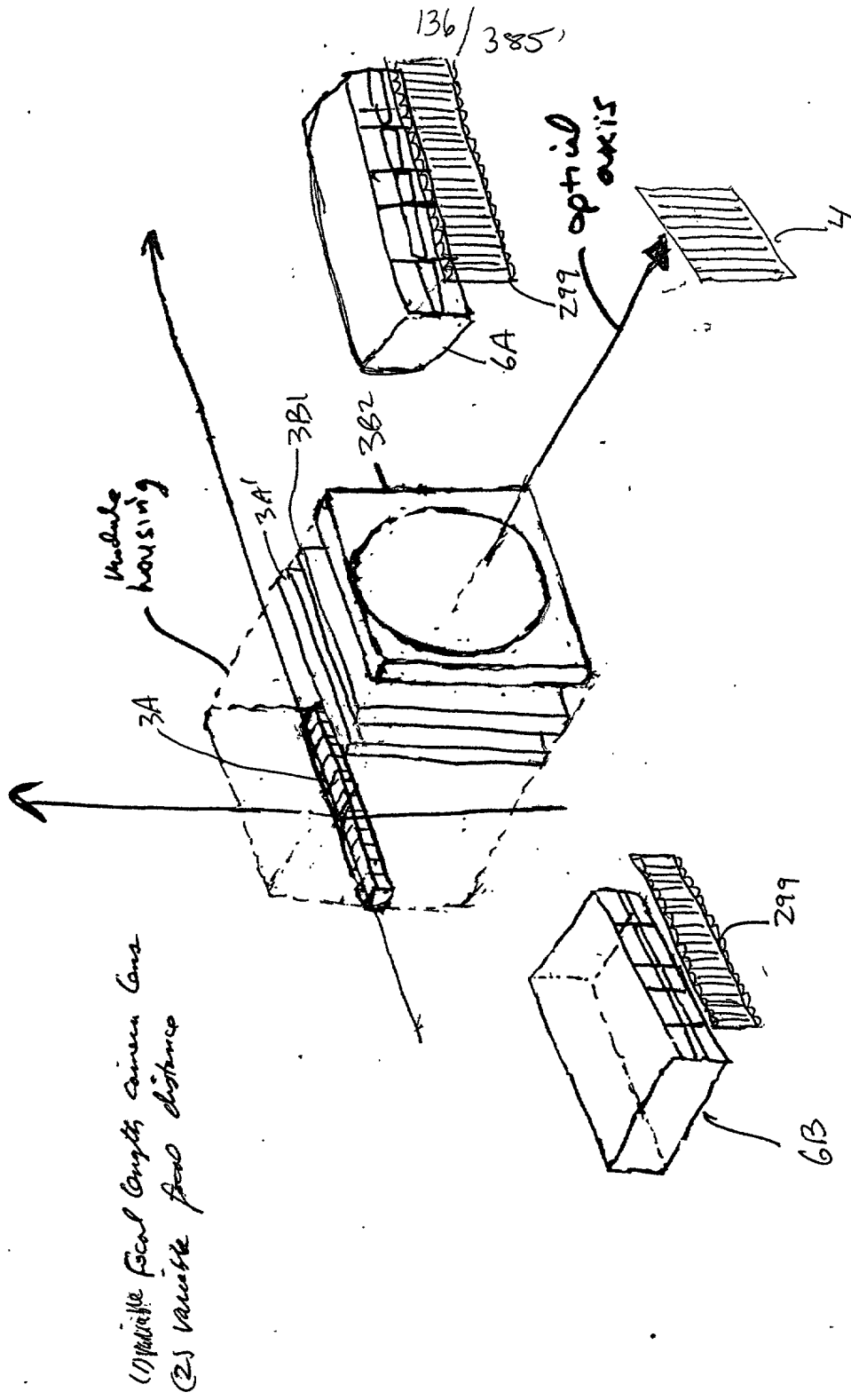
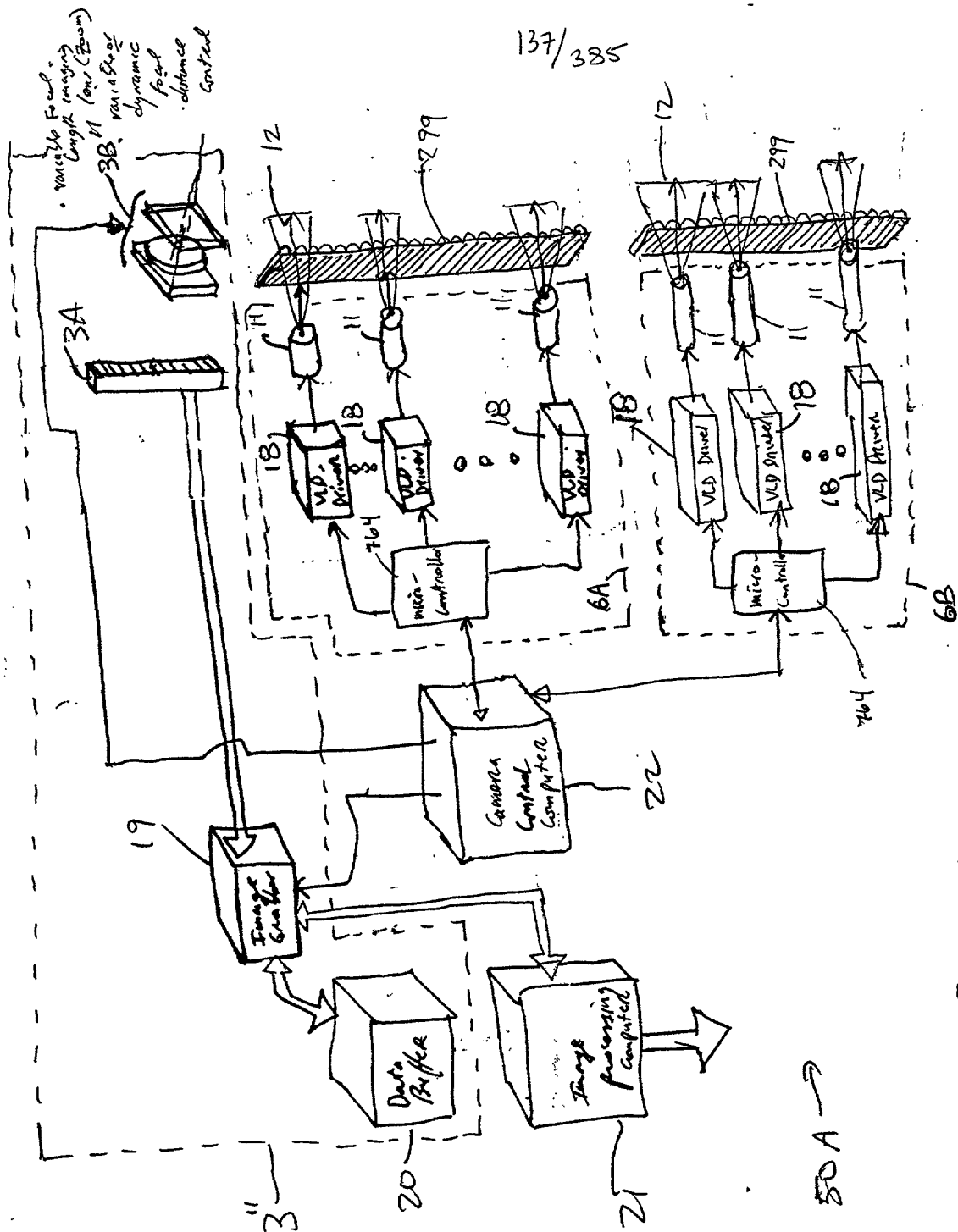
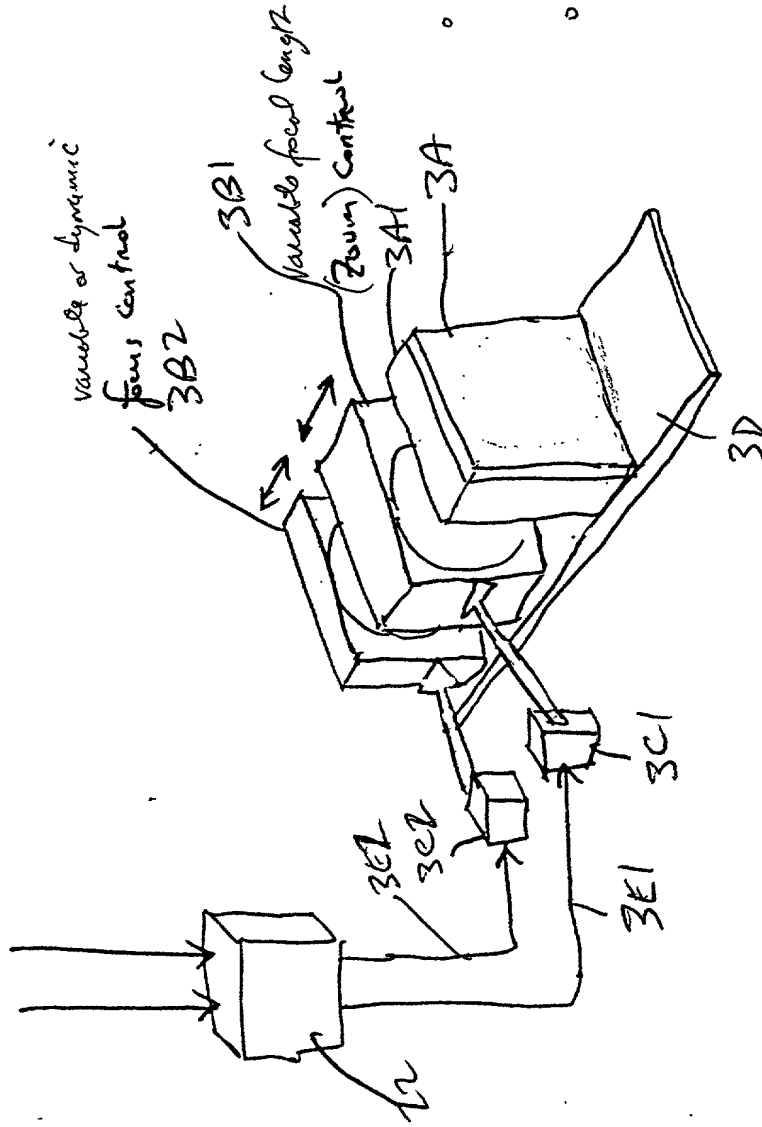


FIG. 3B2

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- Variable focal length camera lens
- Variable focal distance

FIG. 3CZ

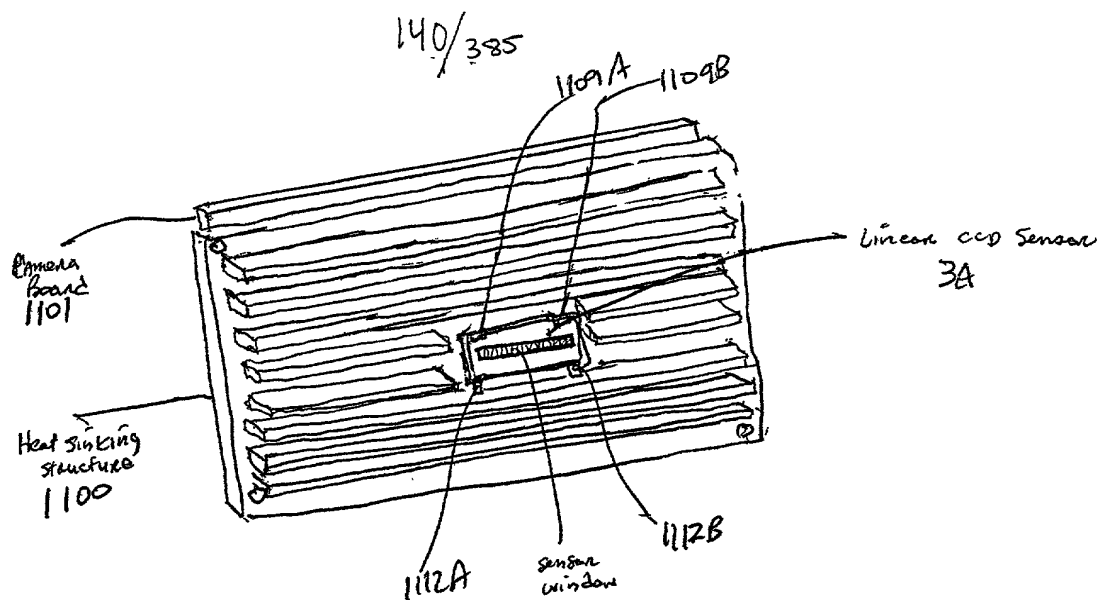


FIG. 3D4

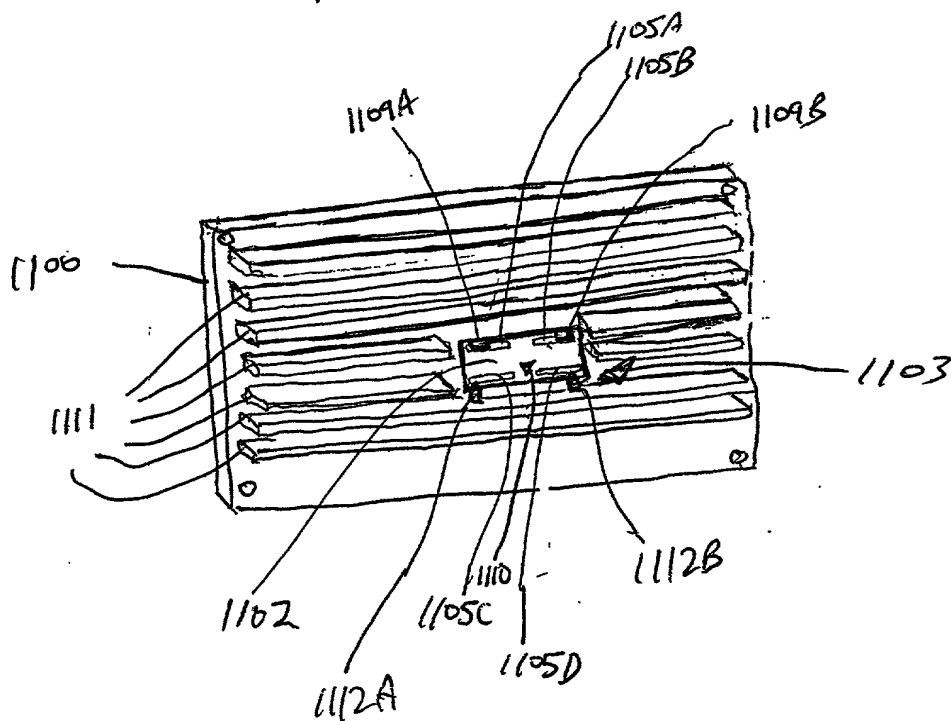


FIG. 3D5

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2
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FIG. 3E1

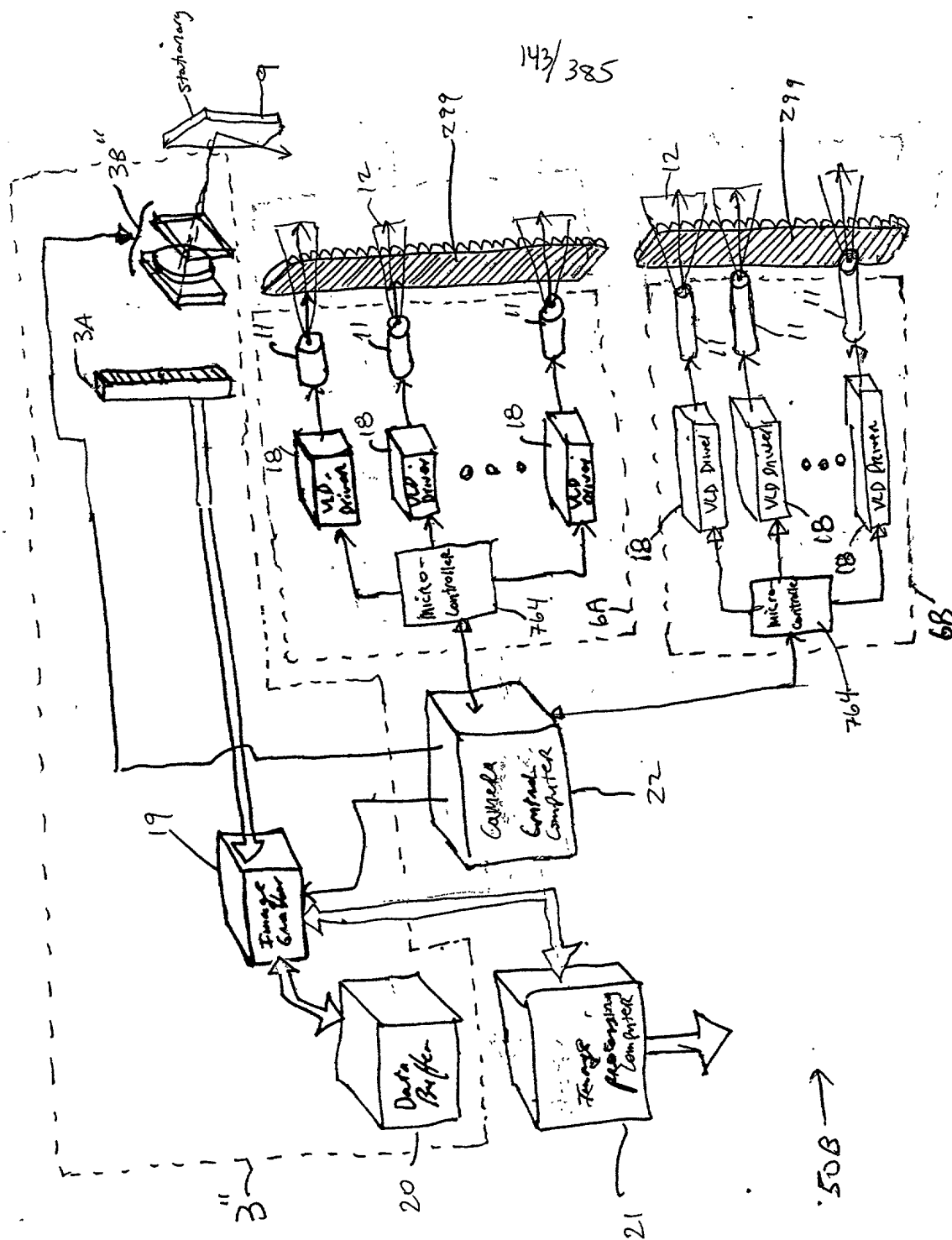


FIG. 3E2

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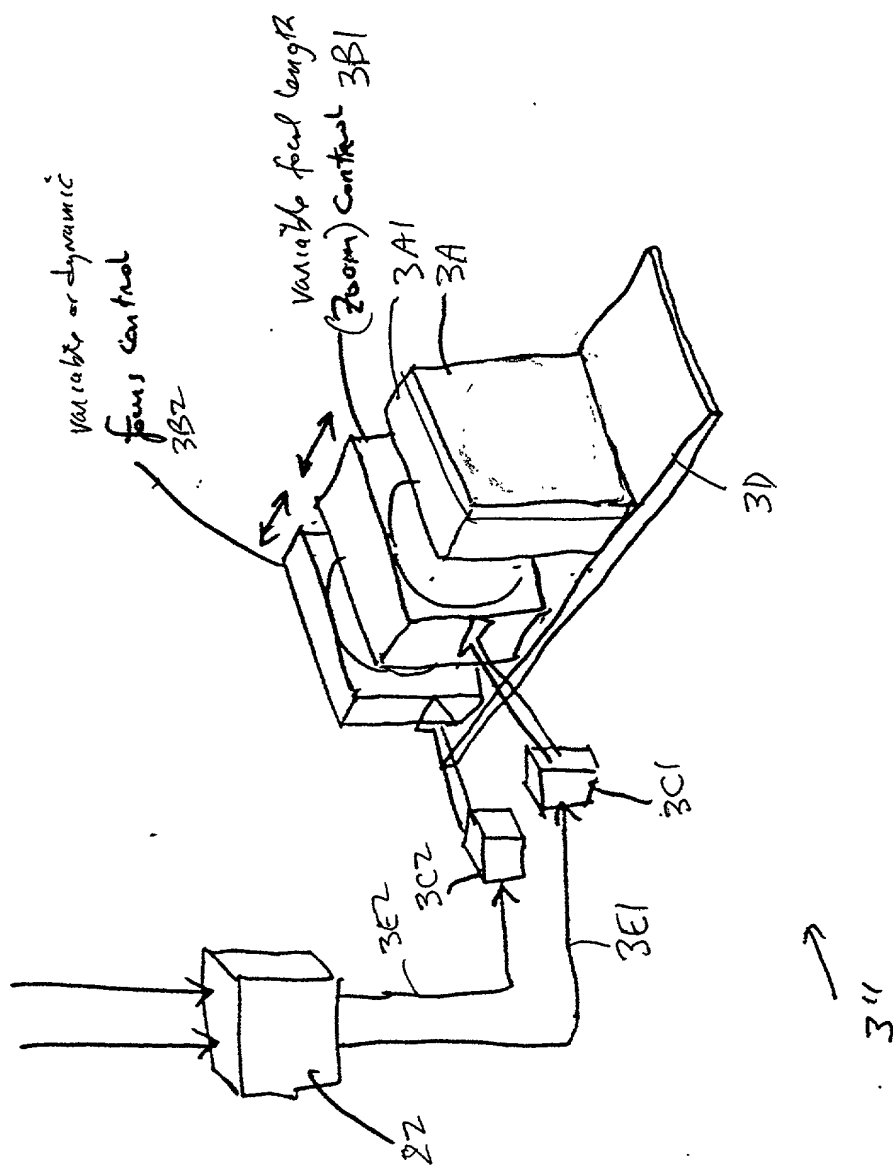
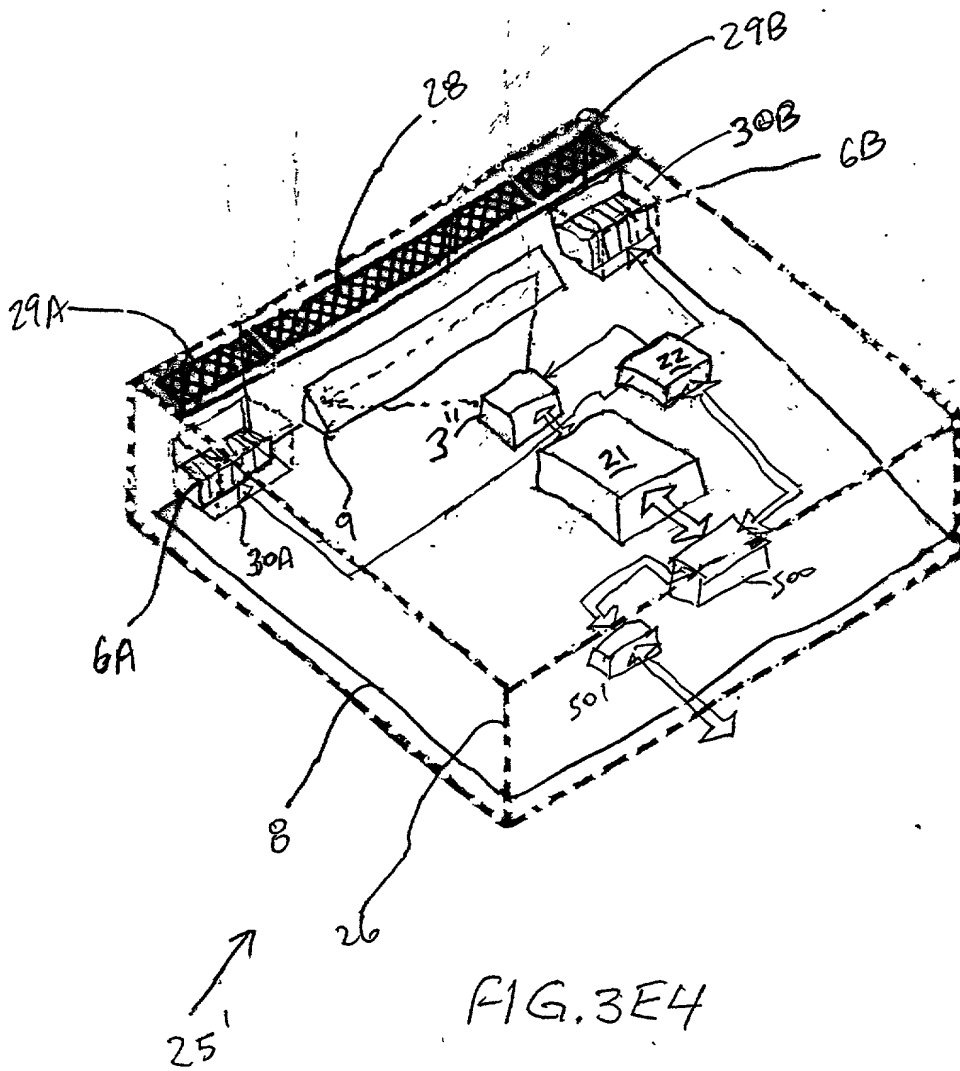


FIG. 3E3

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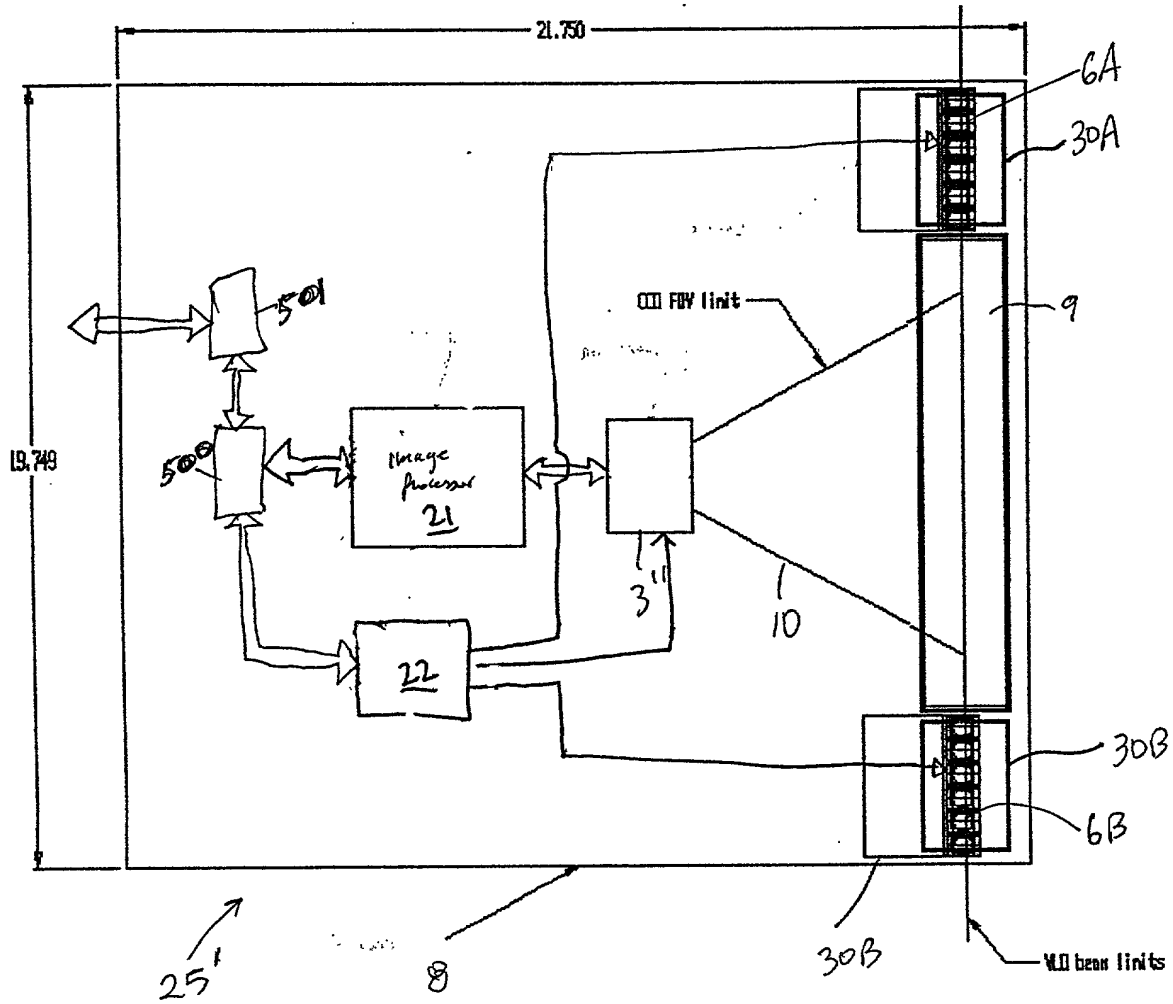


FIG. 3E5

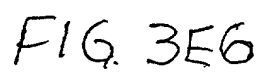
[illegible]

FIG. 3E6

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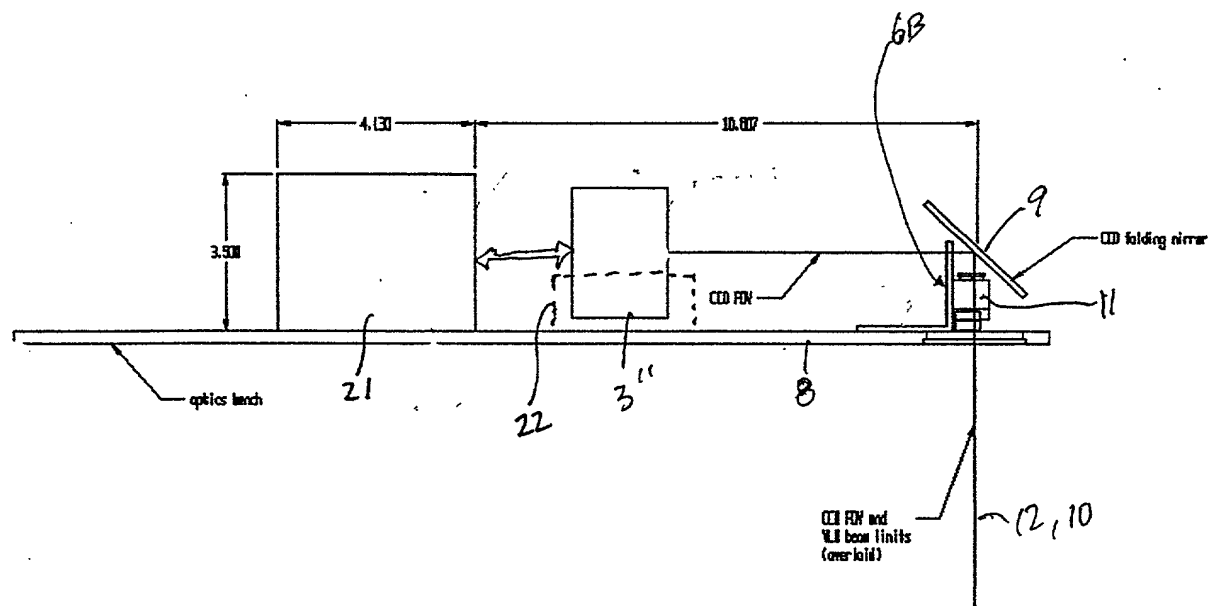


FIG. 3E7

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*Variable FOV

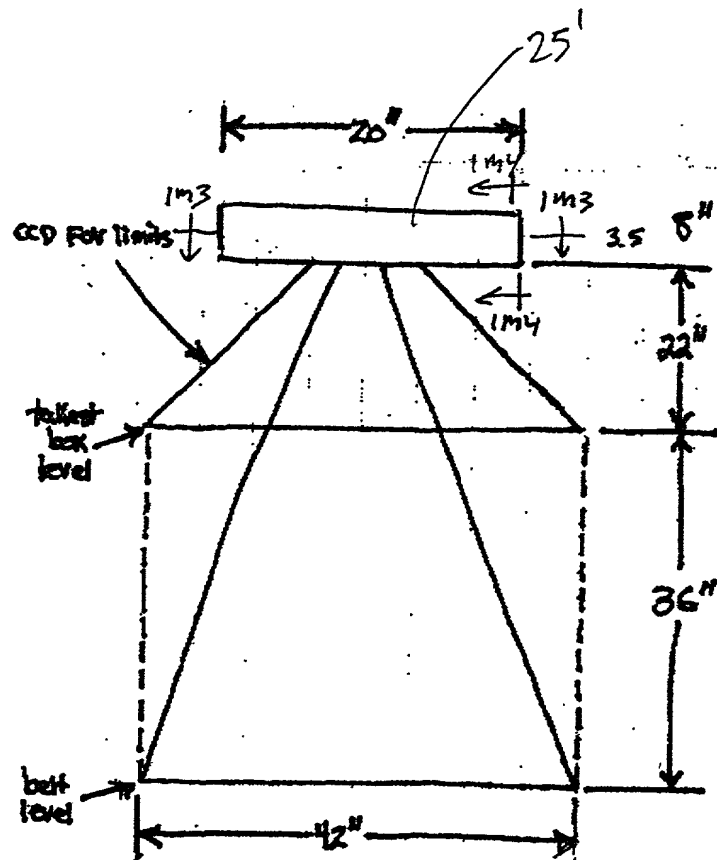


FIG. 3E8

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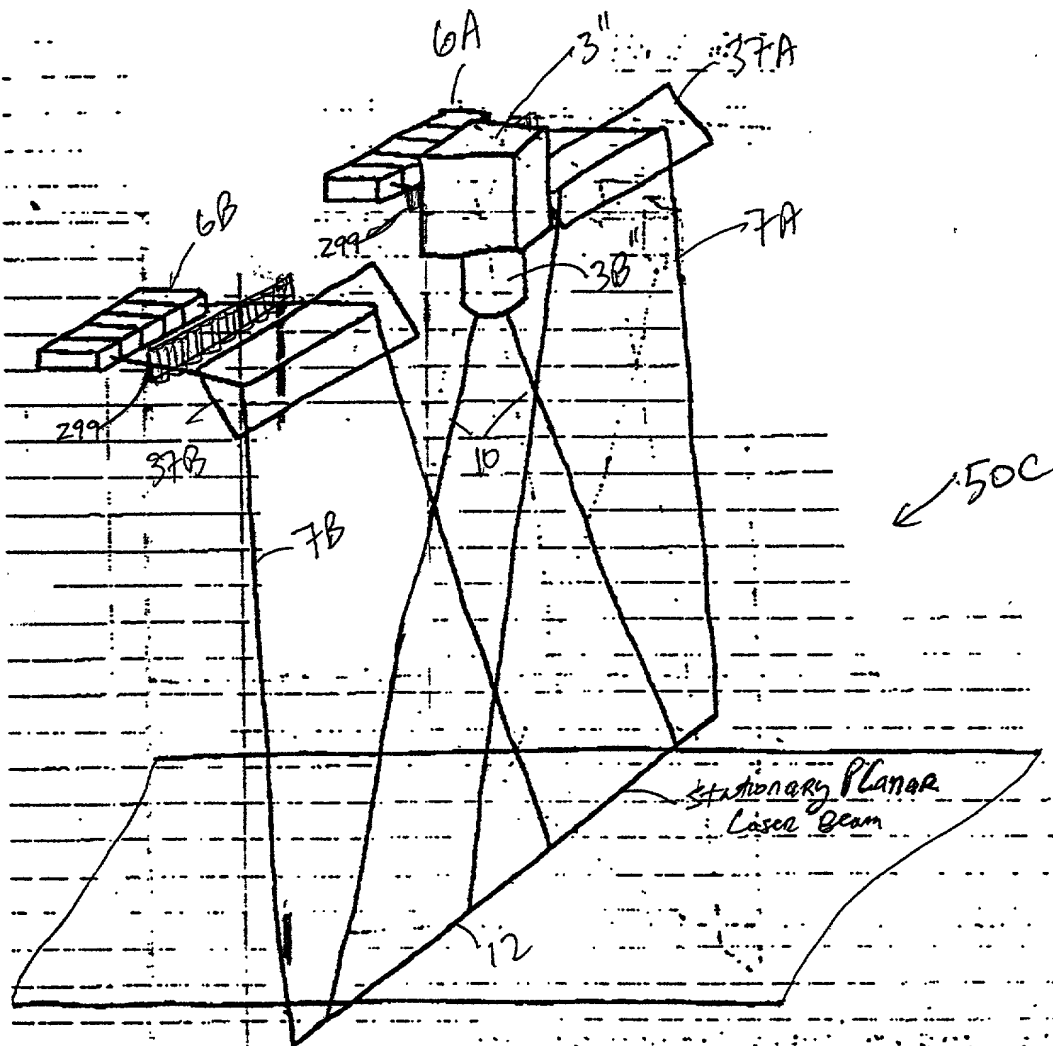
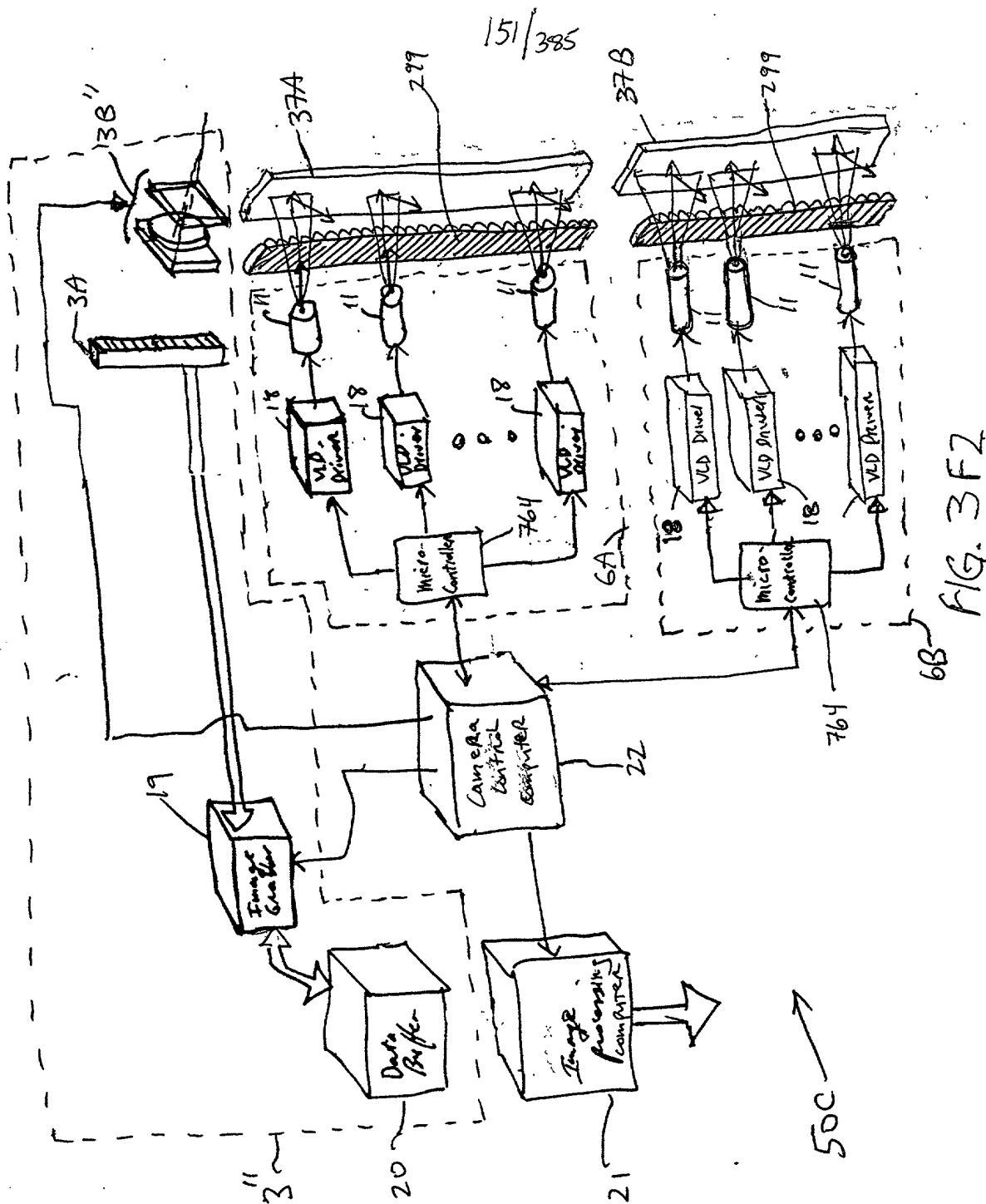


FIG. 3F1



TOP SECRET

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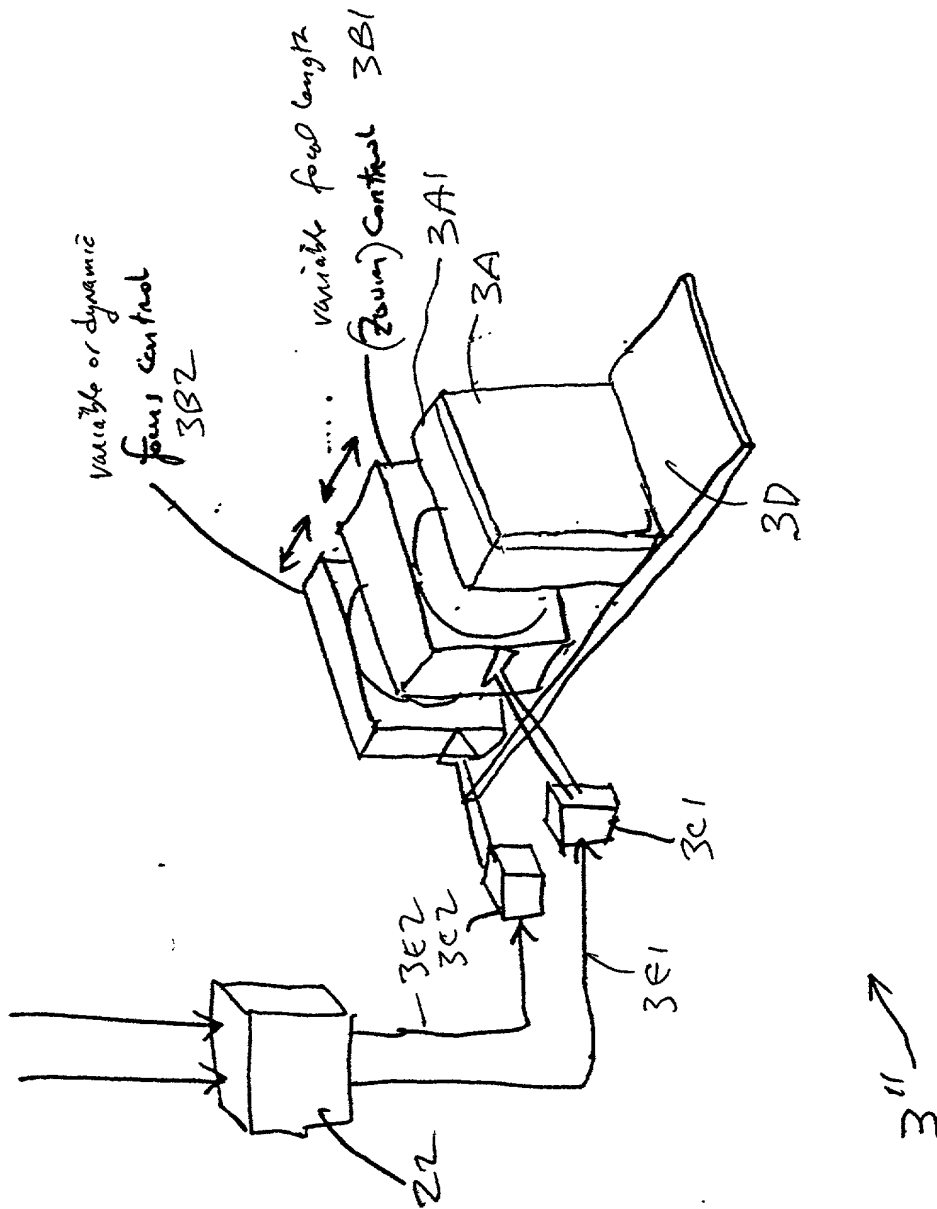


FIG. 3F3

00000000 4404 00000000

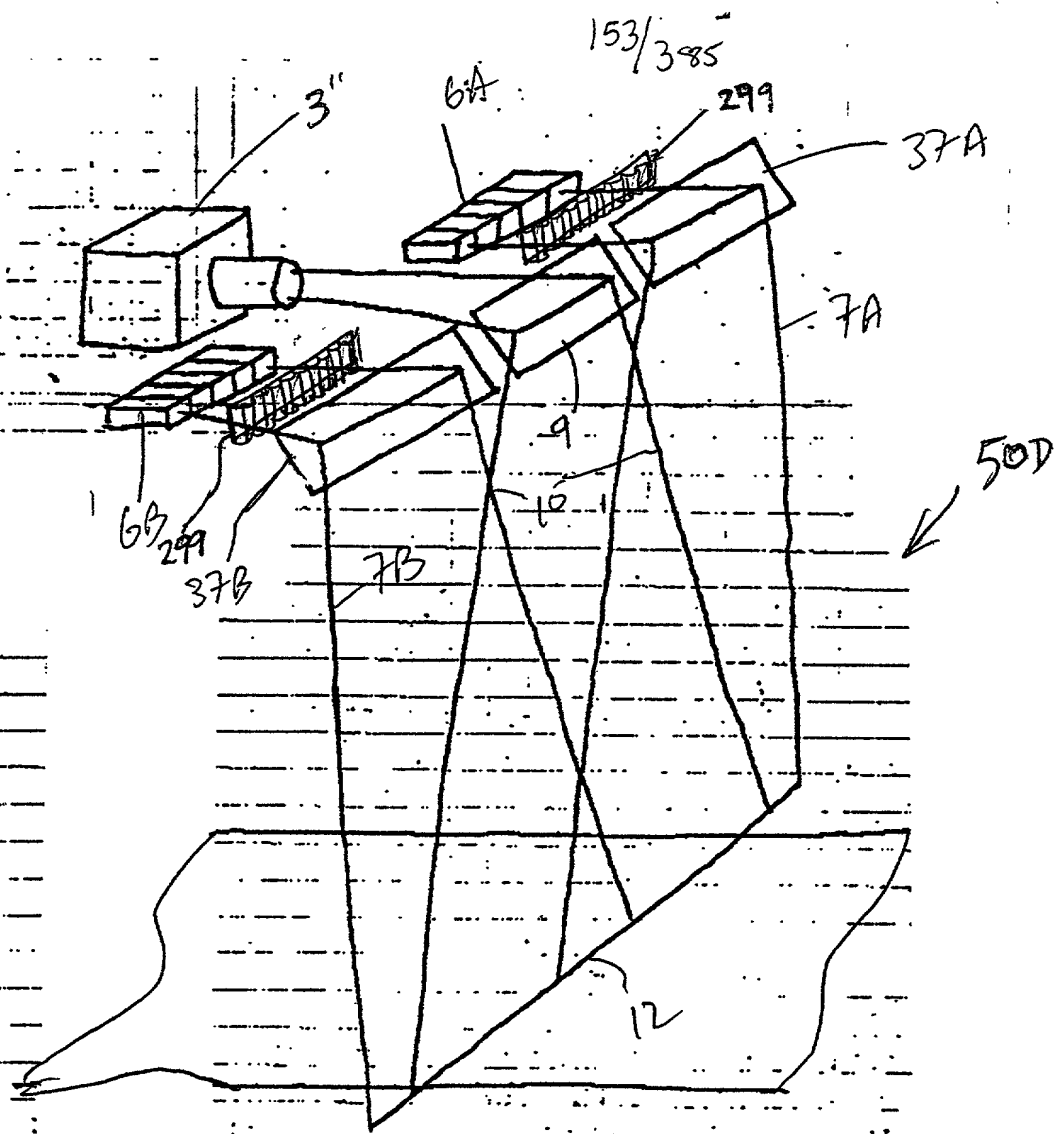


FIG. 3G1

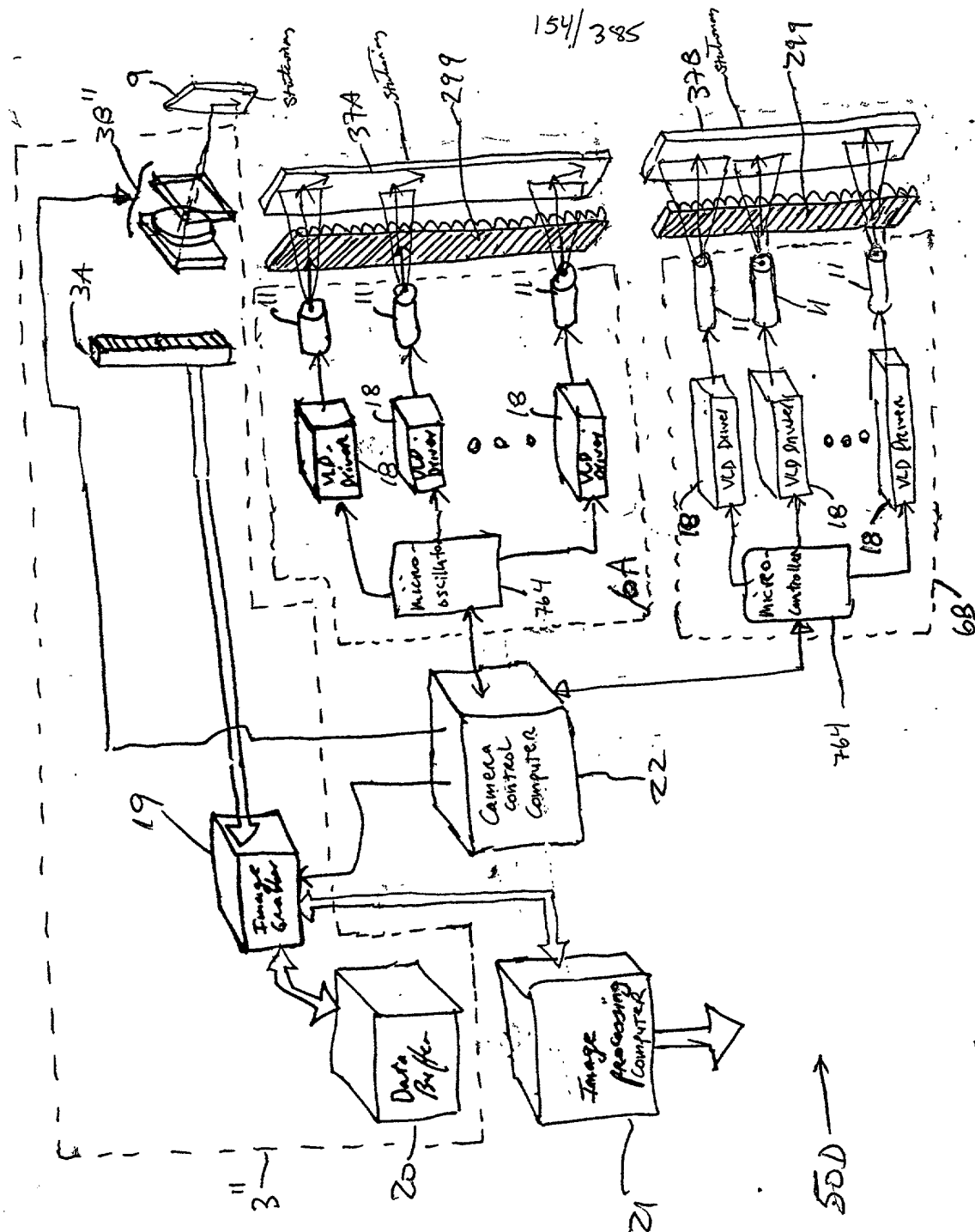


FIG. 392

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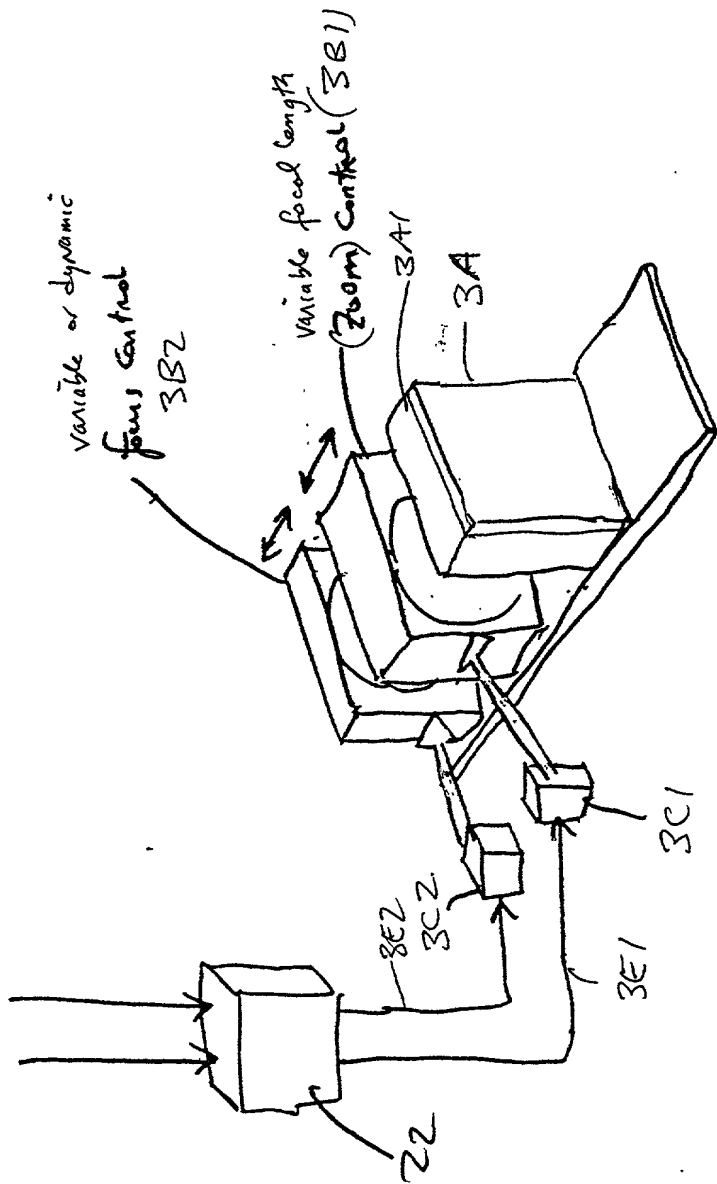


FIG. 393

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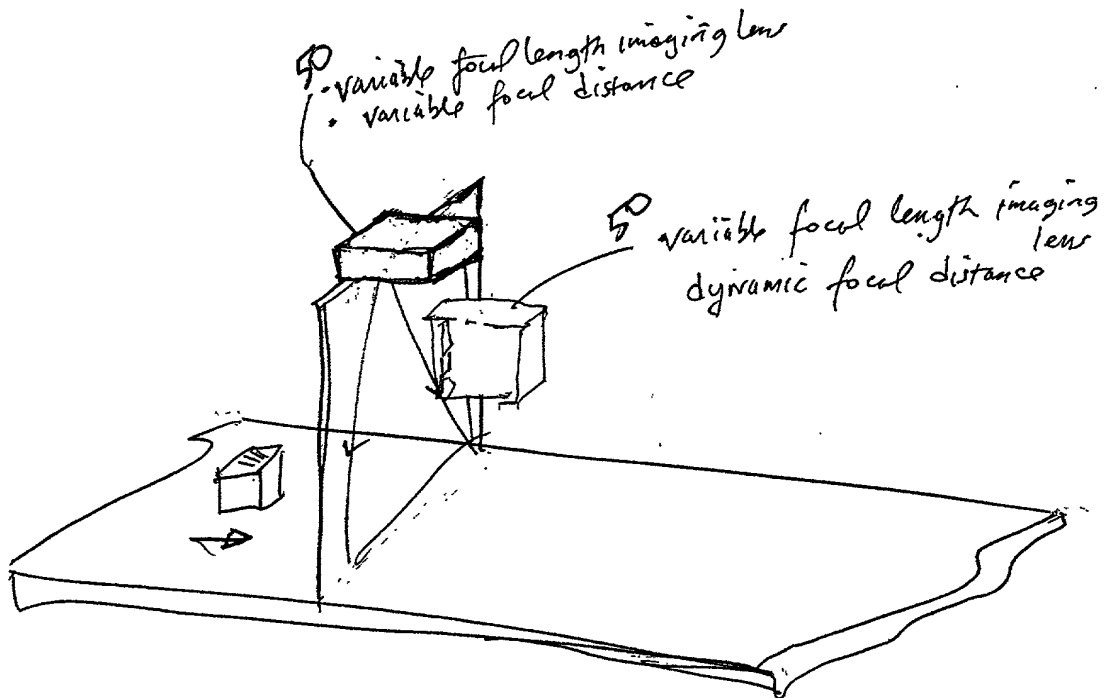


FIG. 3H

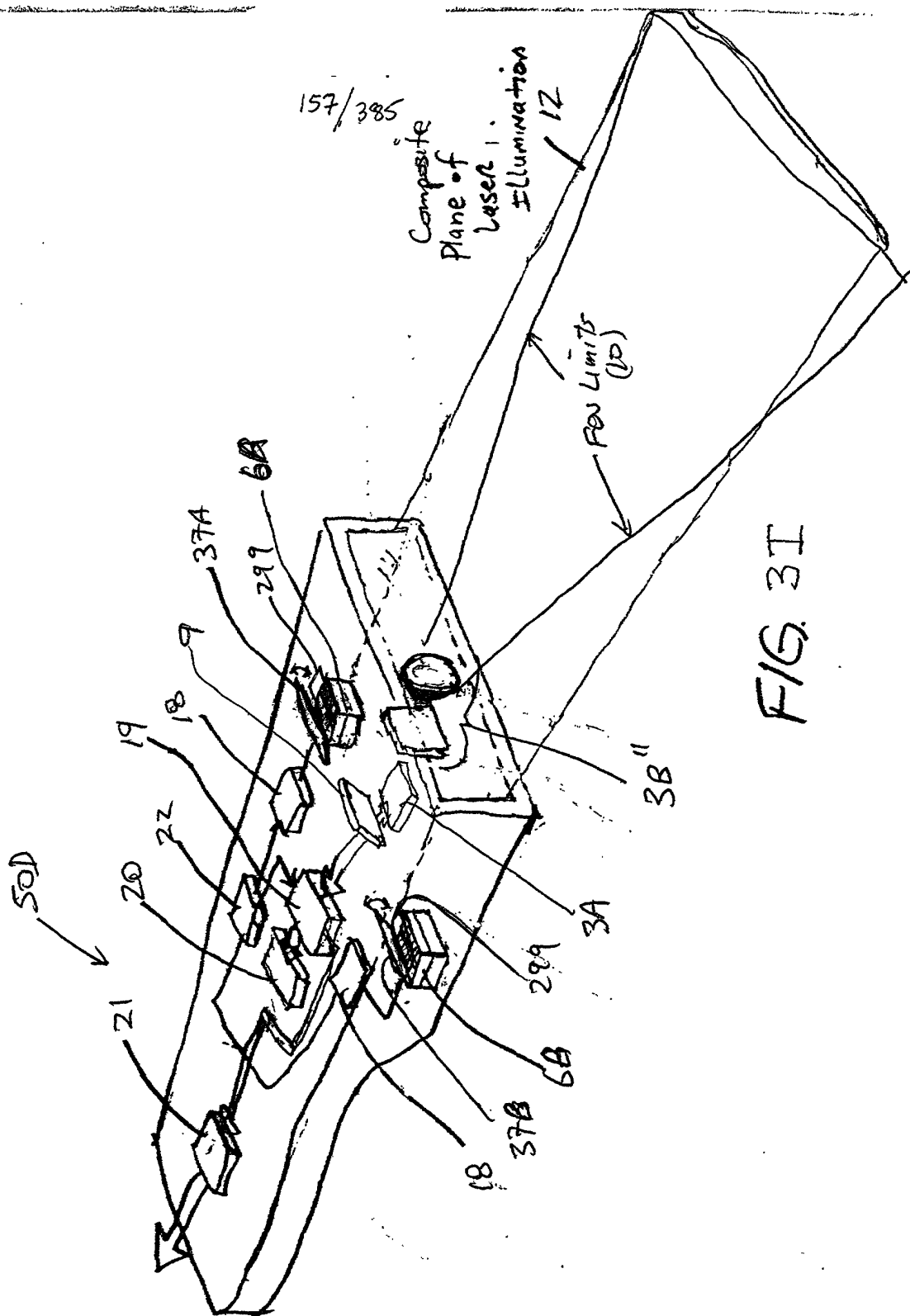


FIG. 31

Pat. 5,306,600

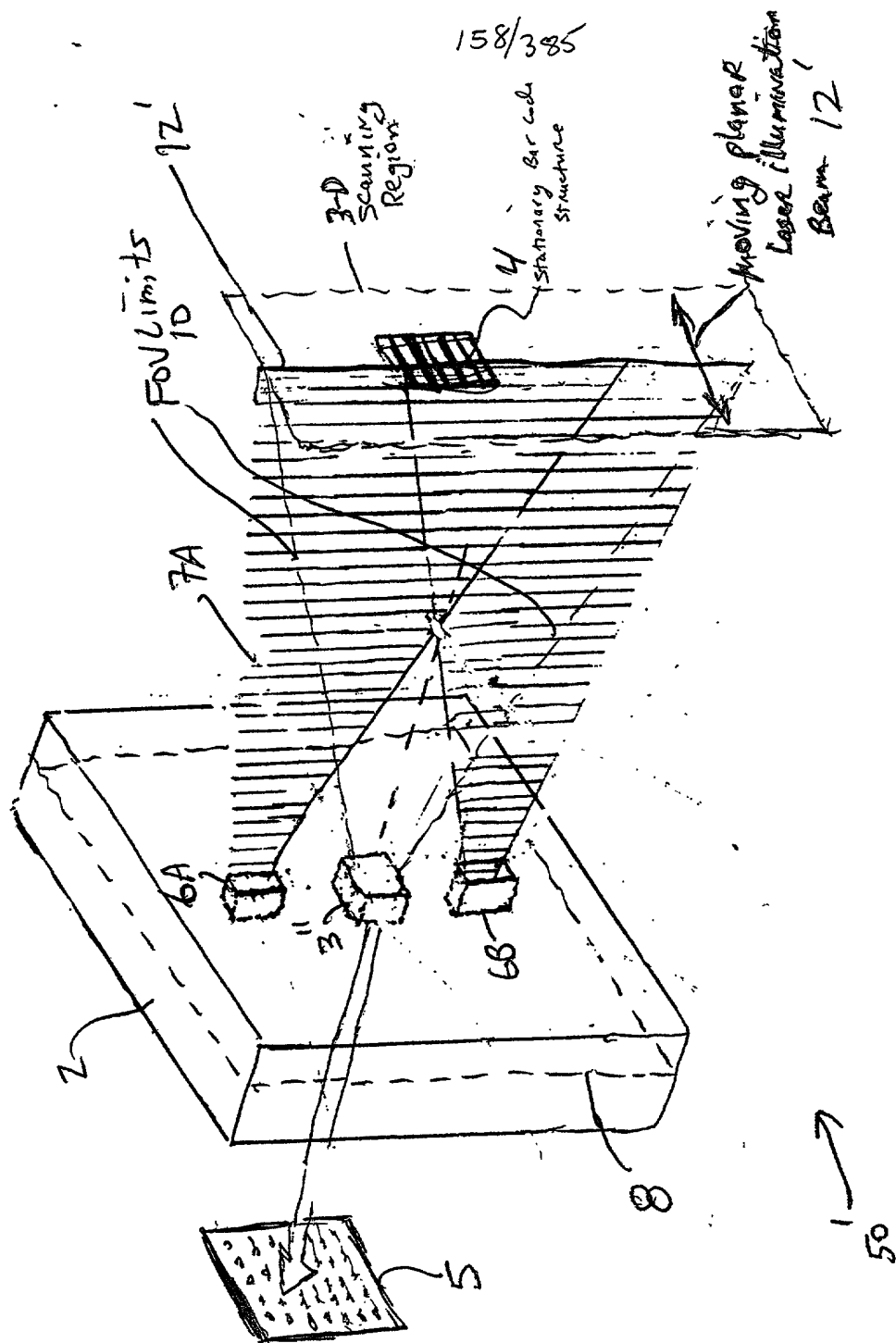


FIG. 3J1

000055 44101
TOTAL 5890660

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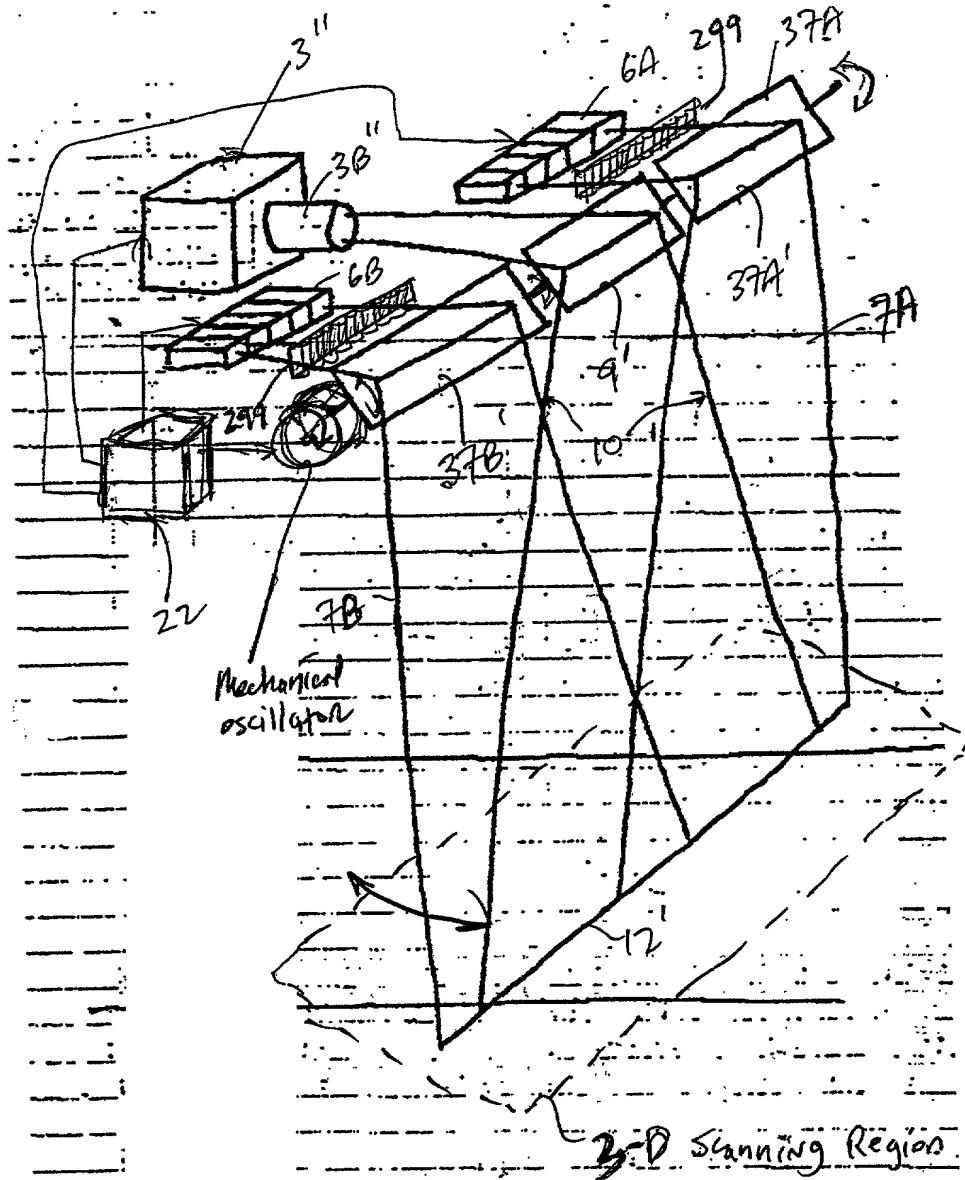
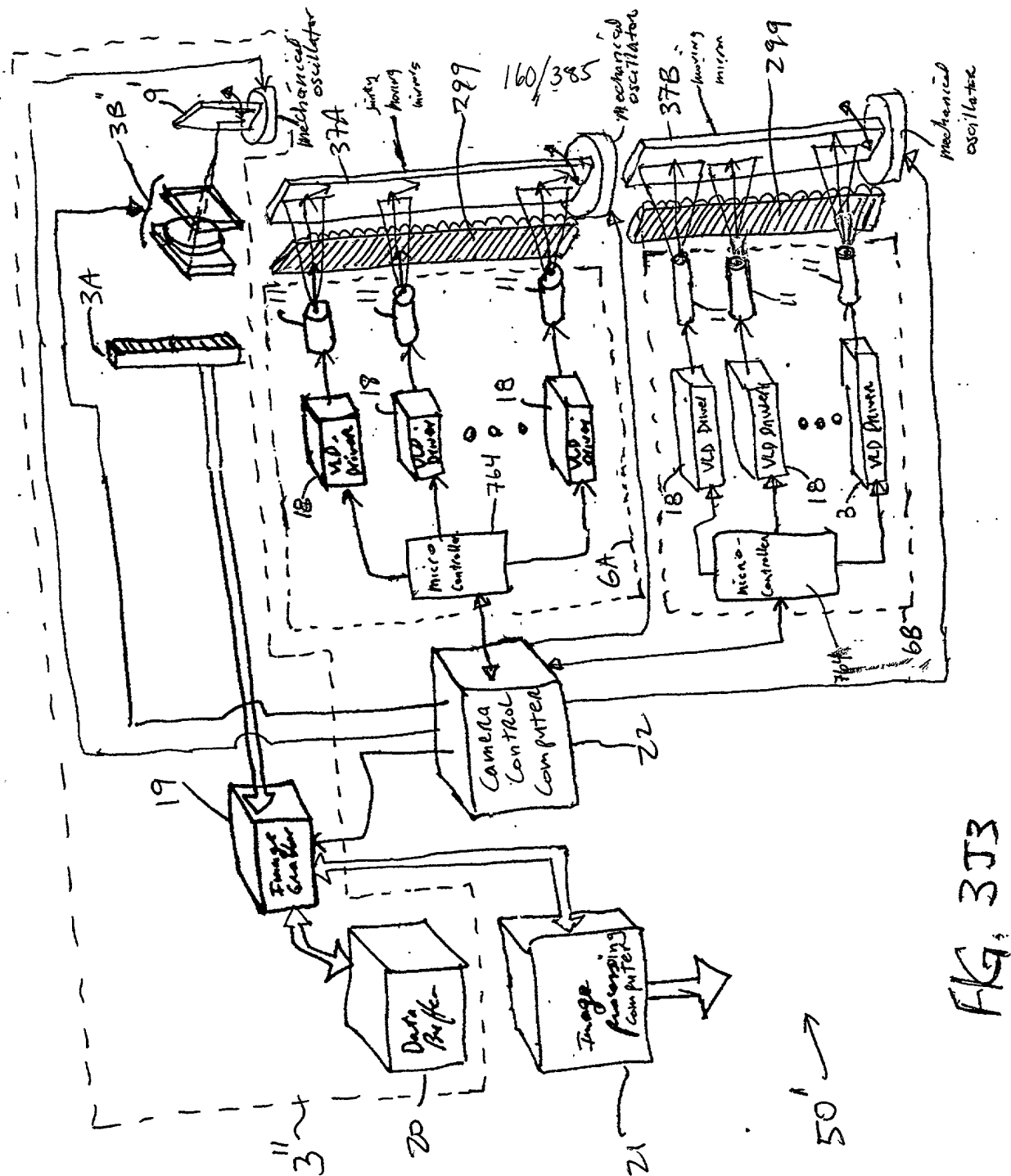


FIG 3J2



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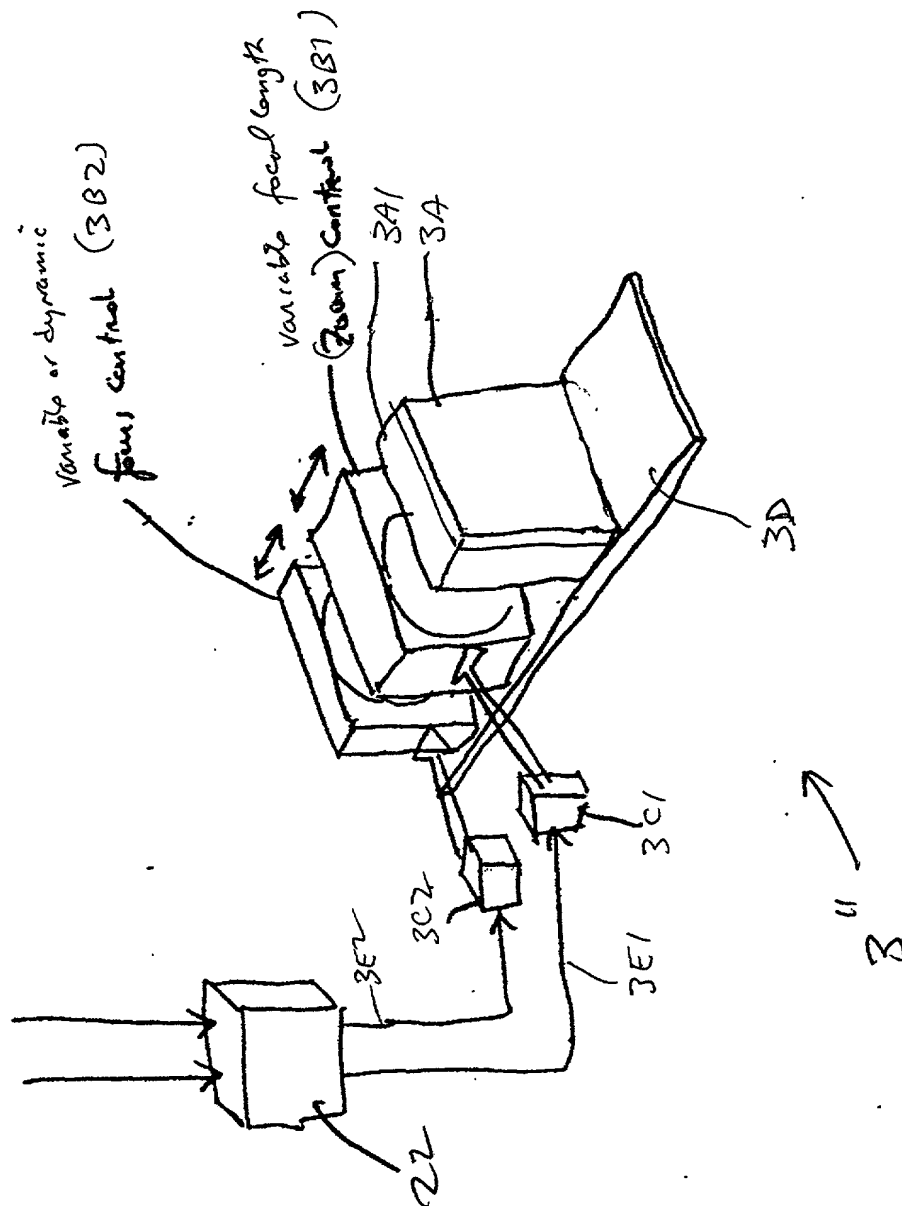


FIG. 3J4

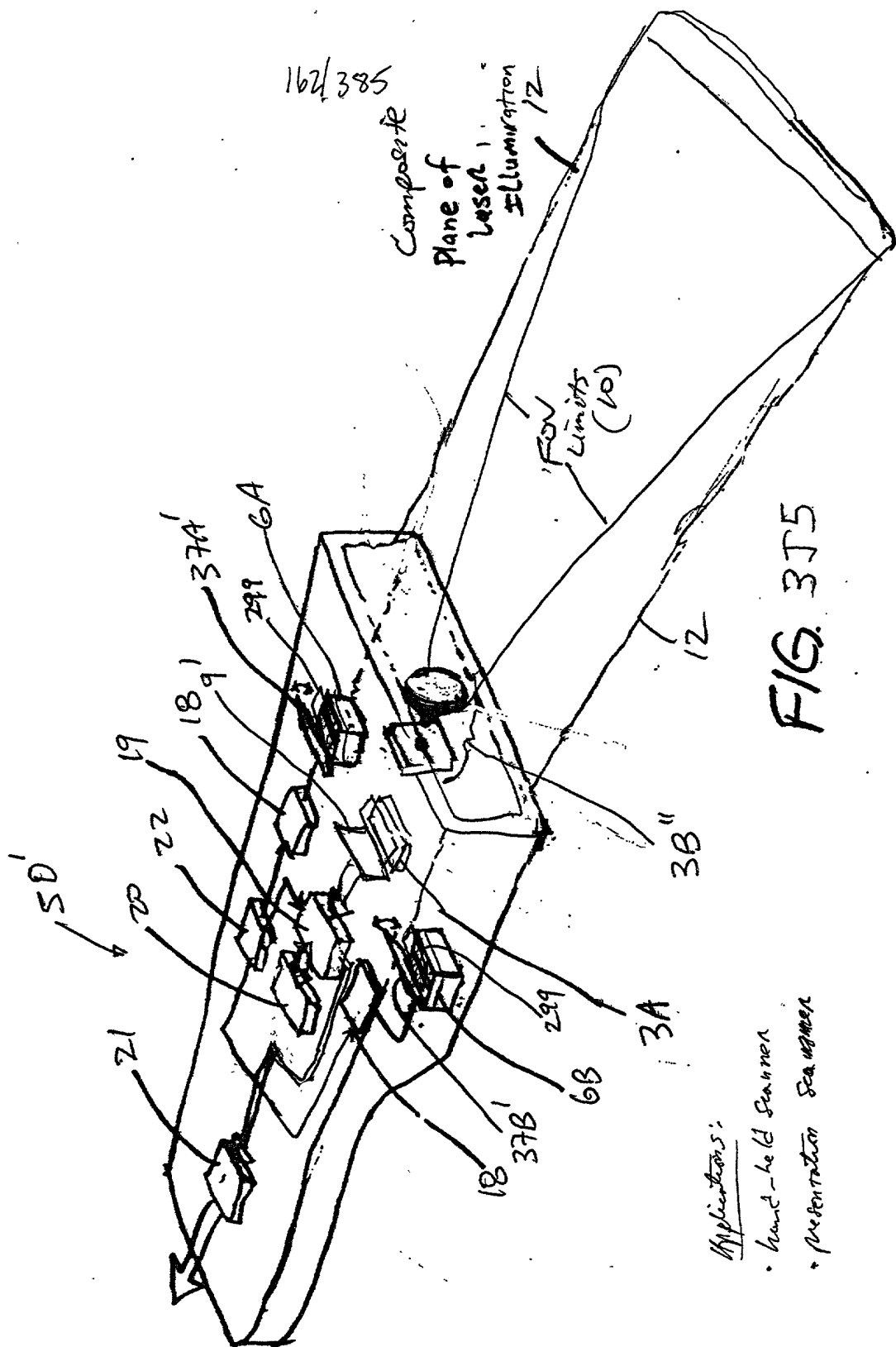


FIG. 3T5

Applications:

- hand-held scanner
- presentation scanner

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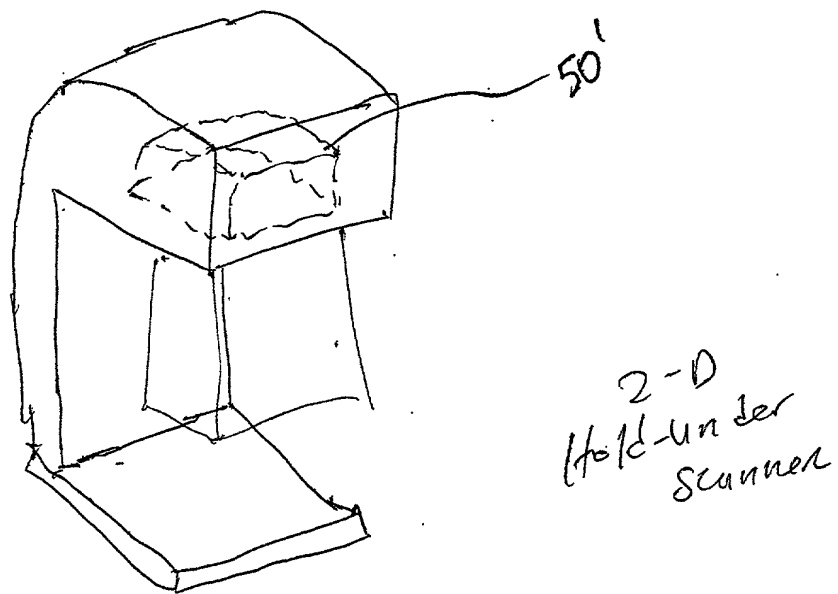


FIG. 316

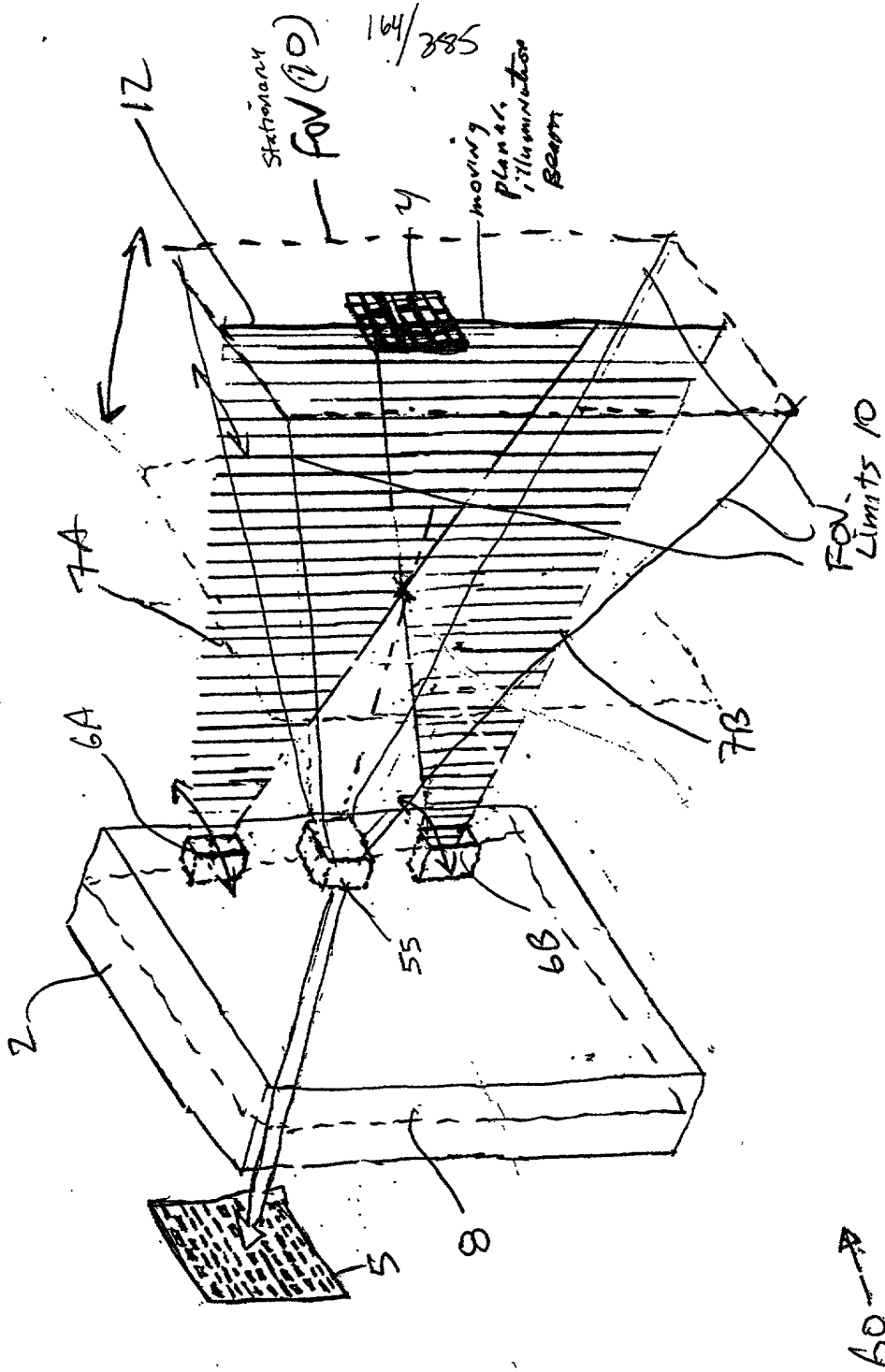


FIG 4A

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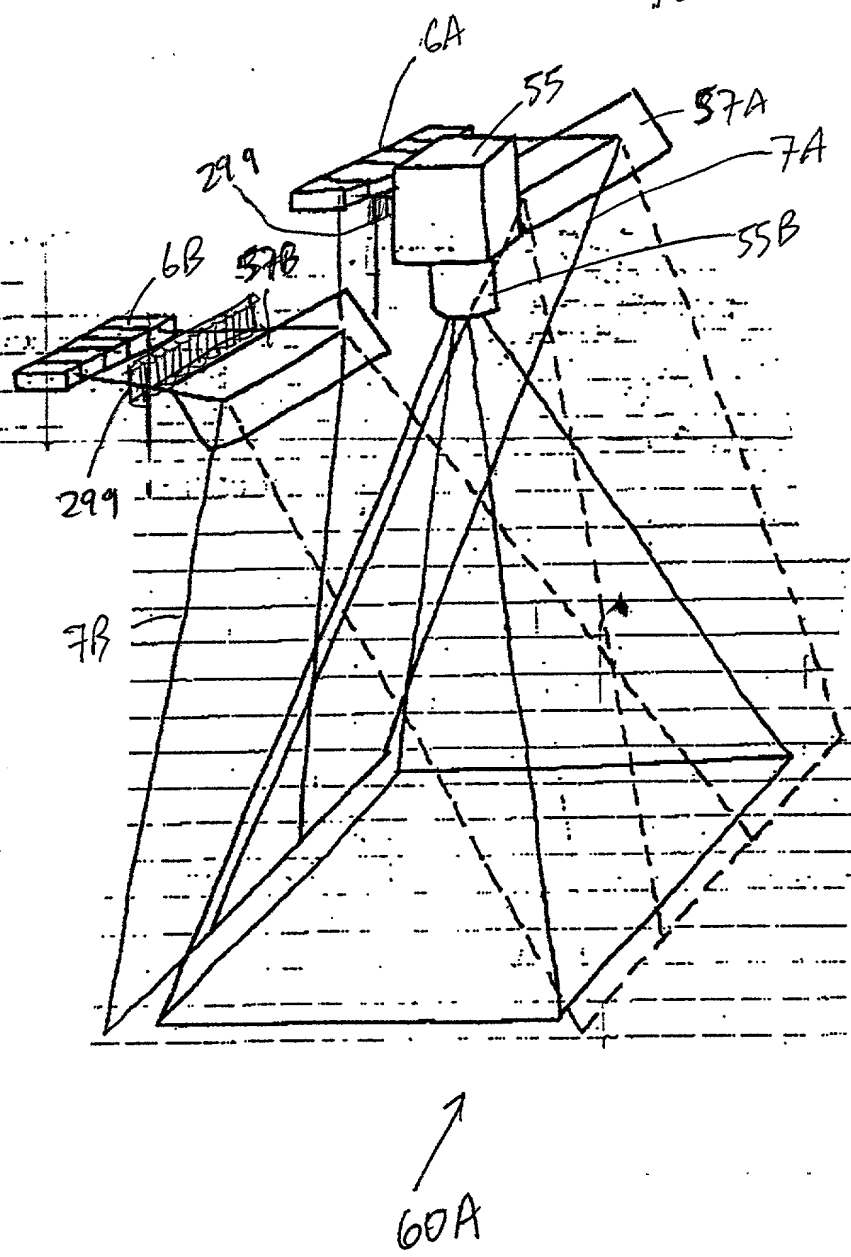


FIG. 4B1

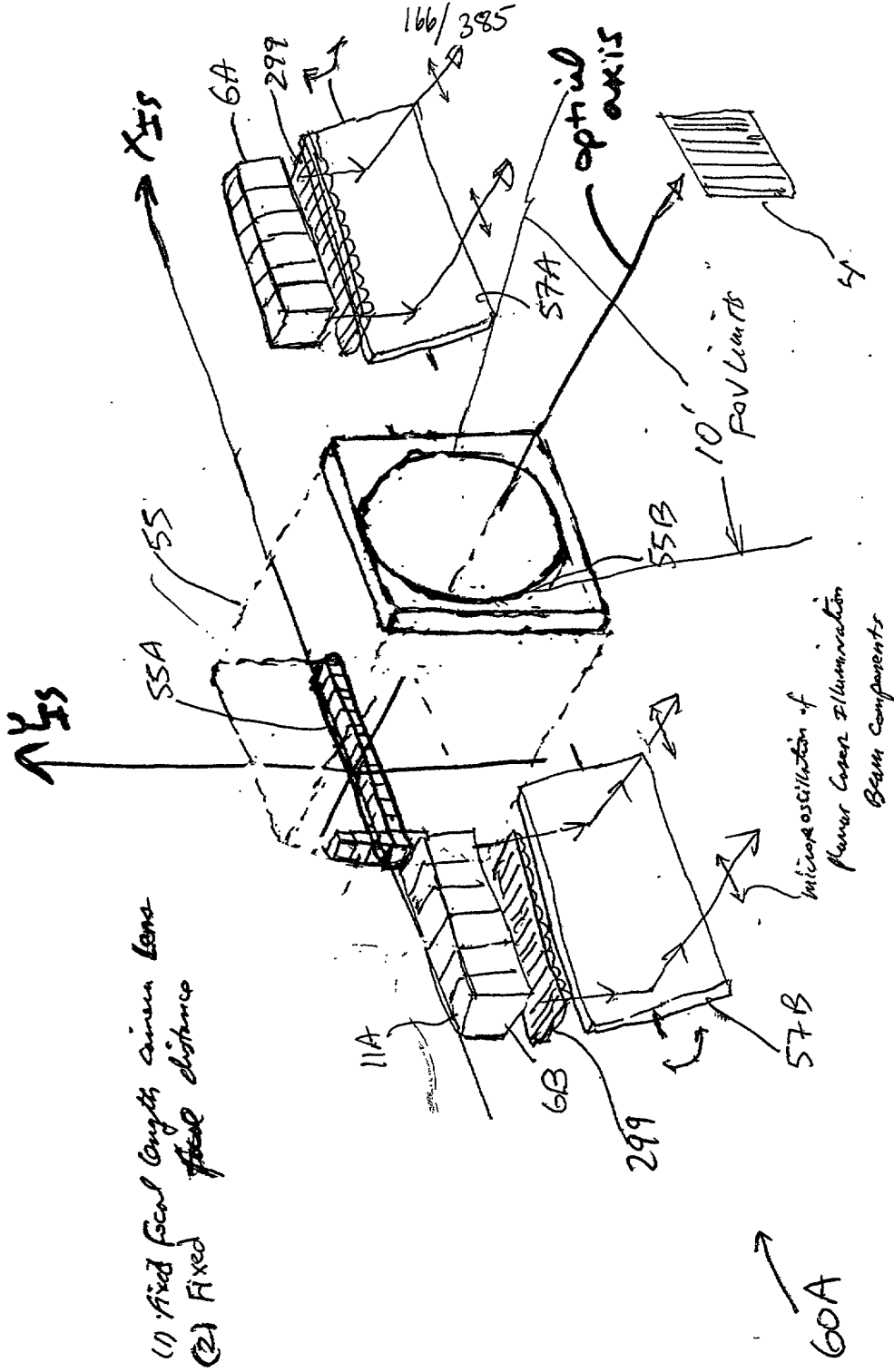
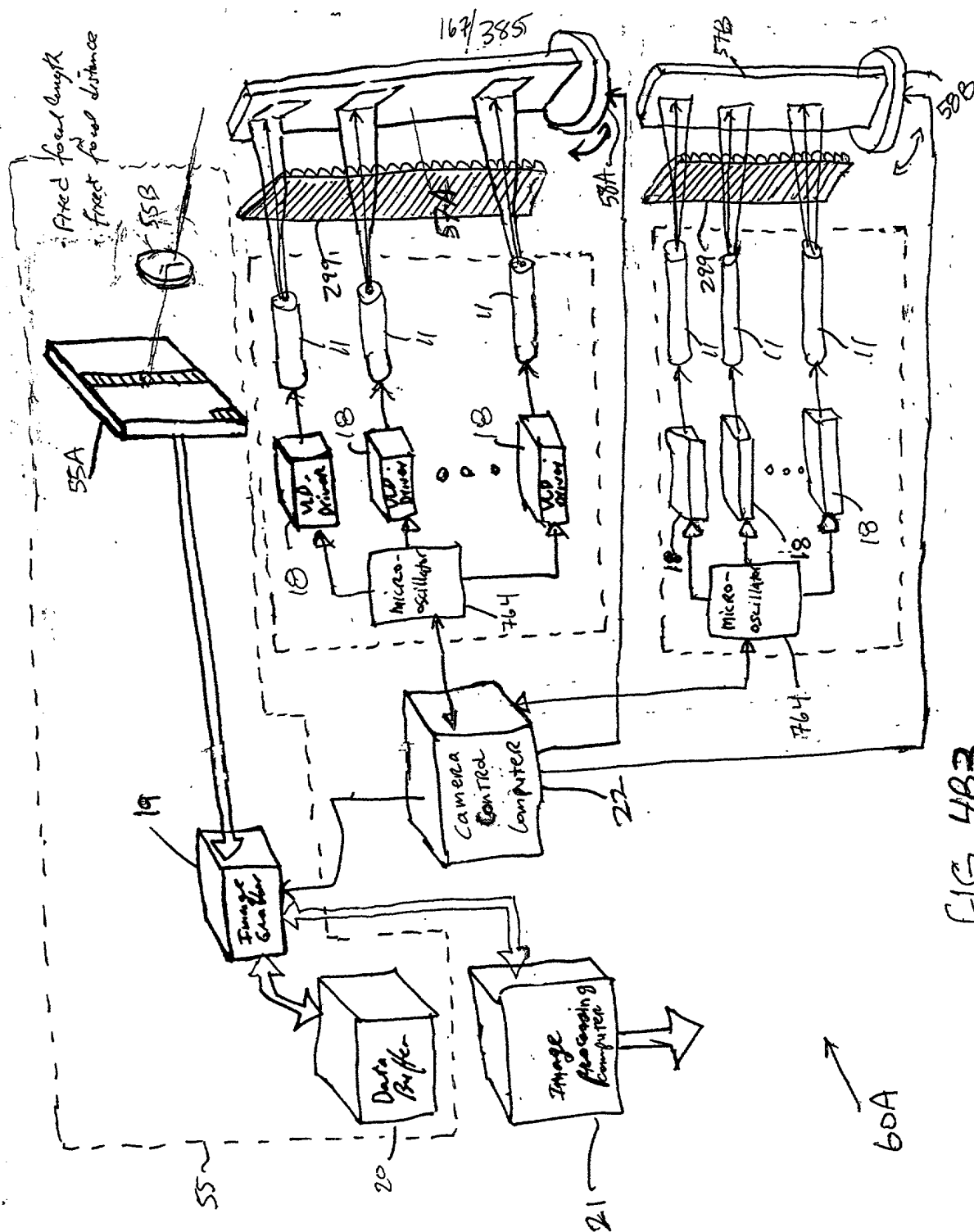


FIG. 4B

[illegible]

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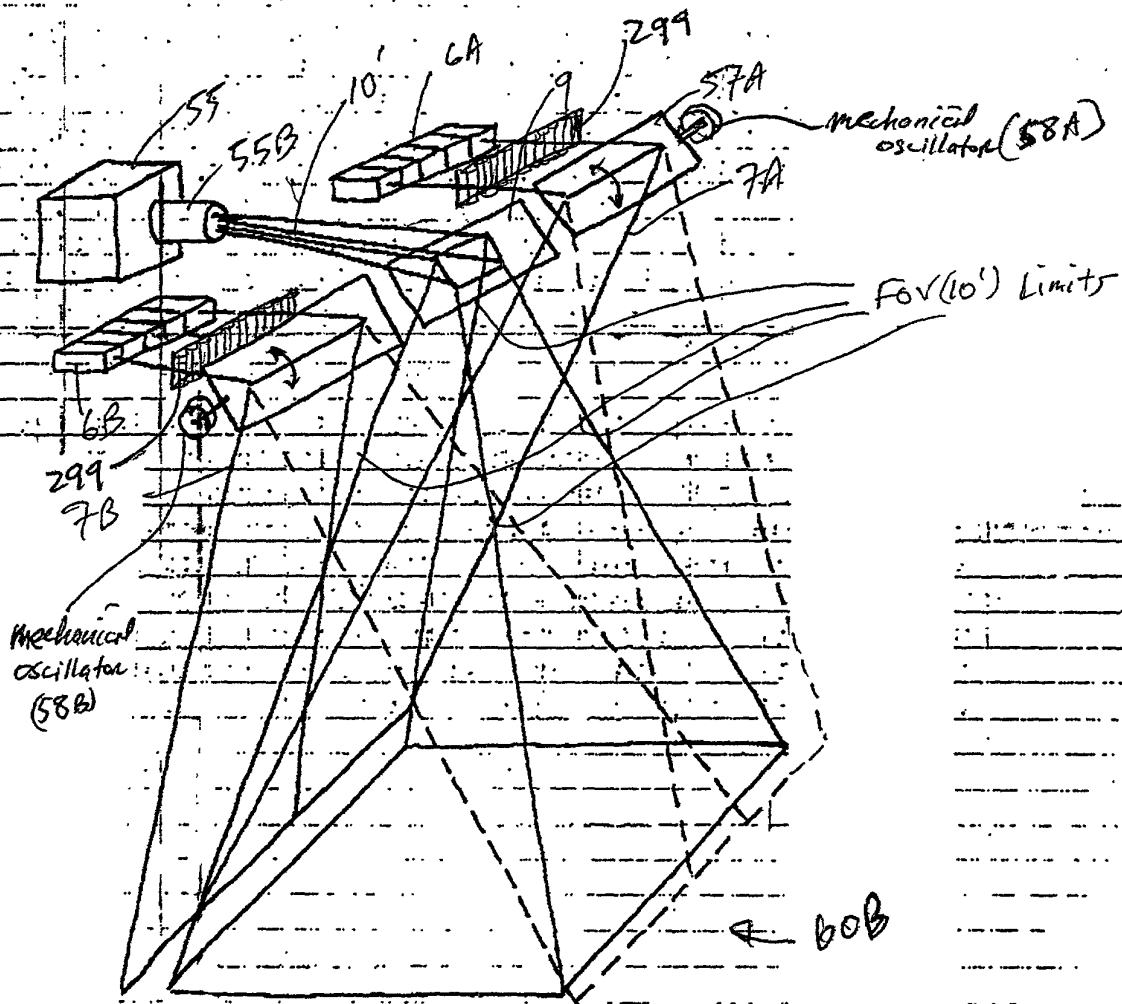
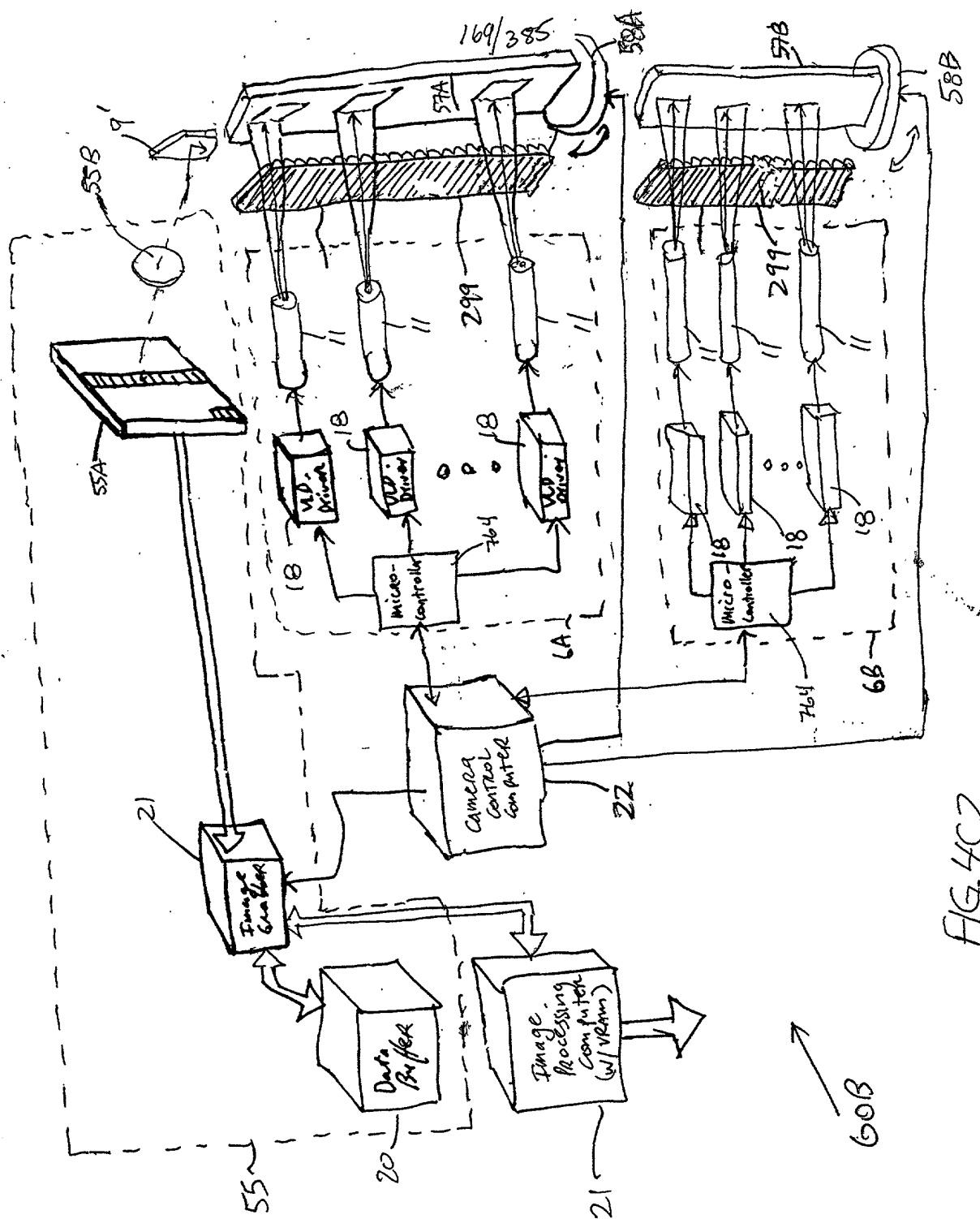


FIG. 4C1



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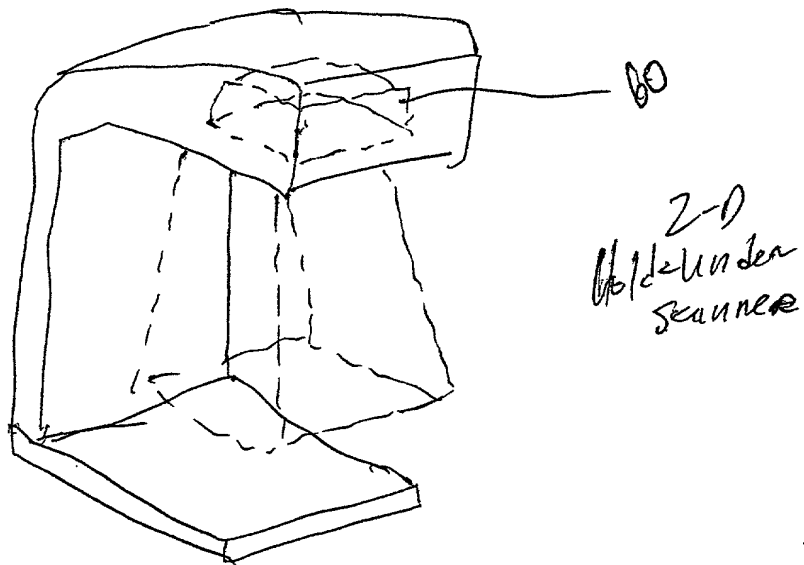


FIG. 4D

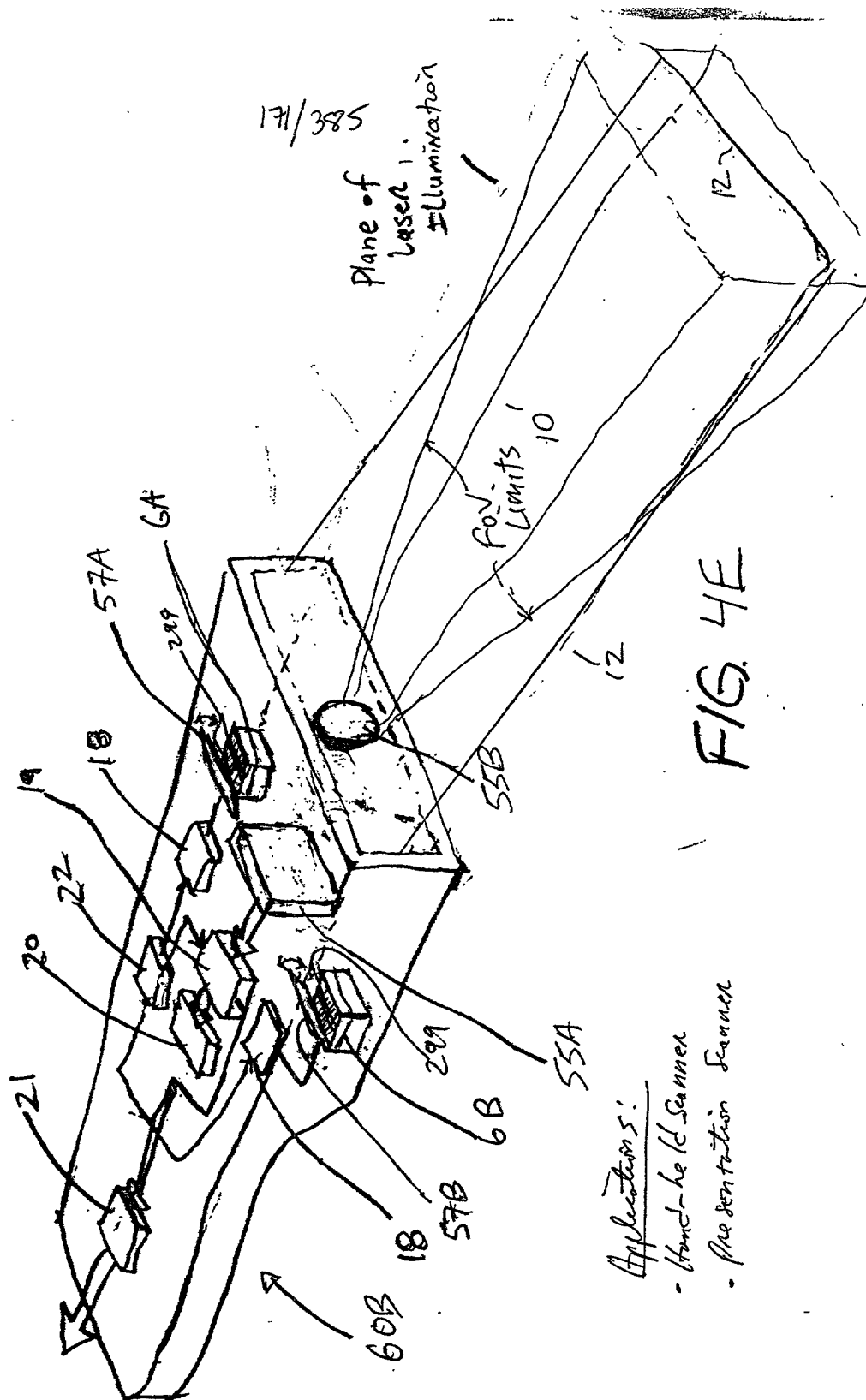


FIG. 4E

Applications:

- Hand-held Scanner
- Presentation Scanner

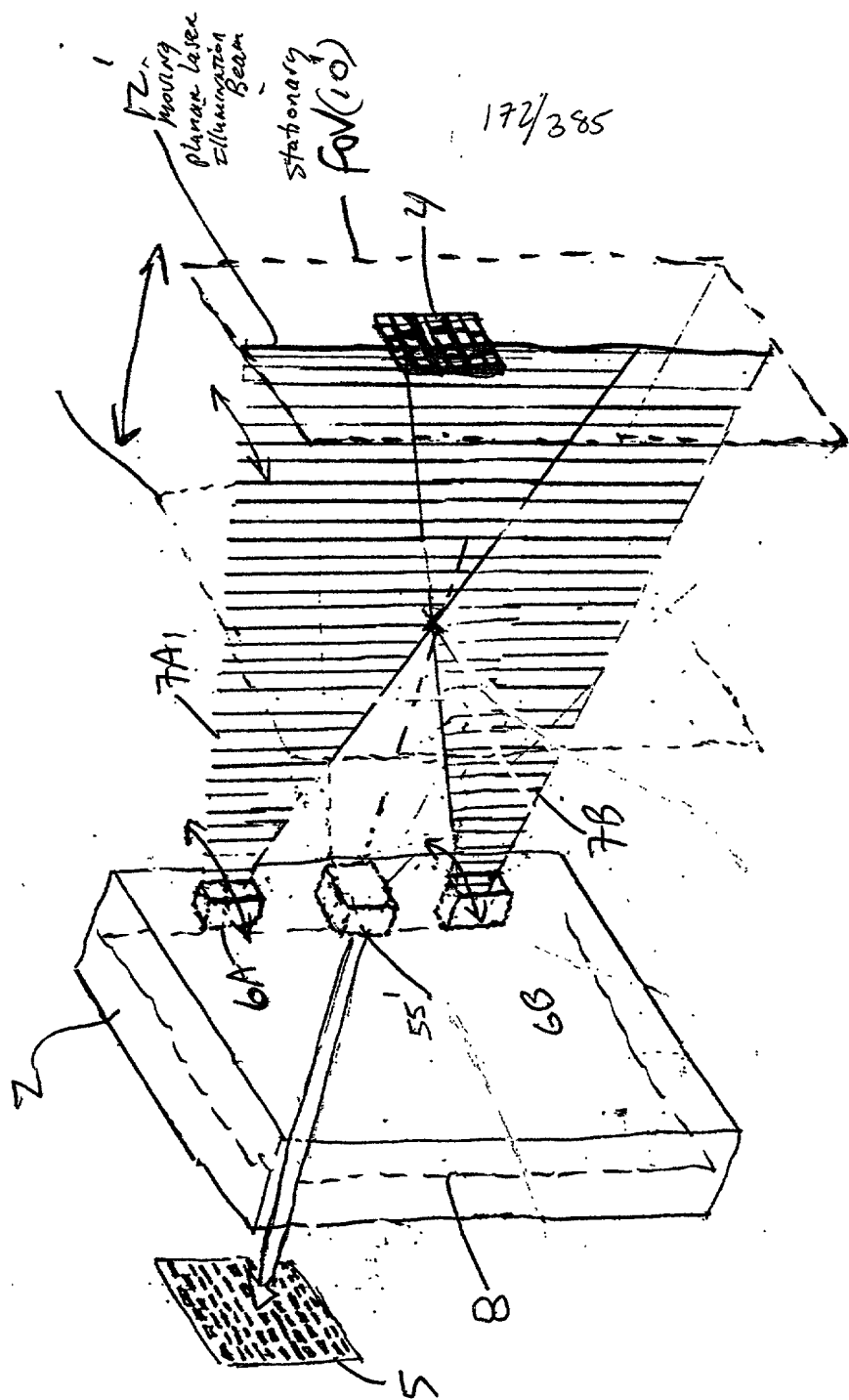


FIG. 5A

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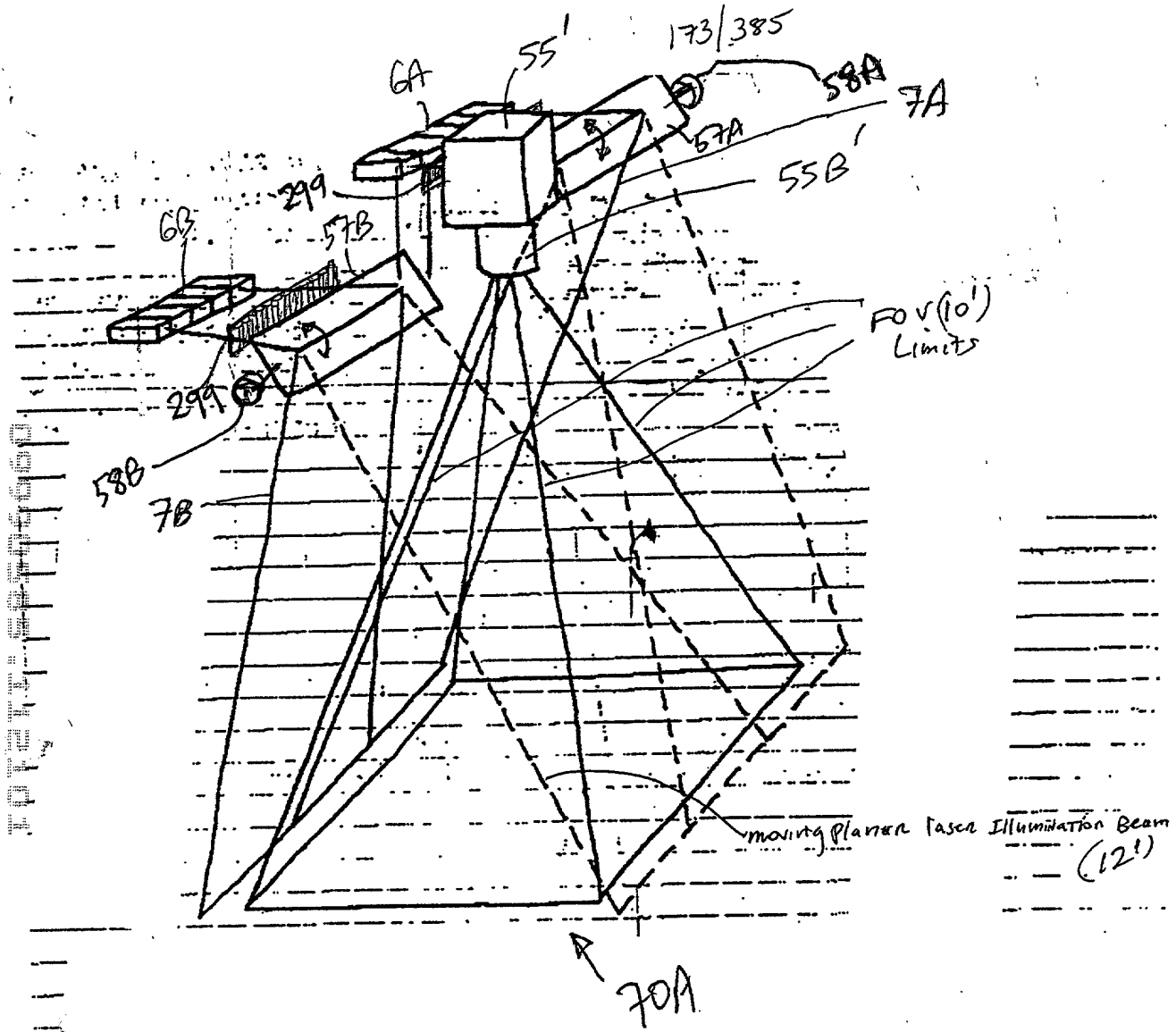


FIG 5B1

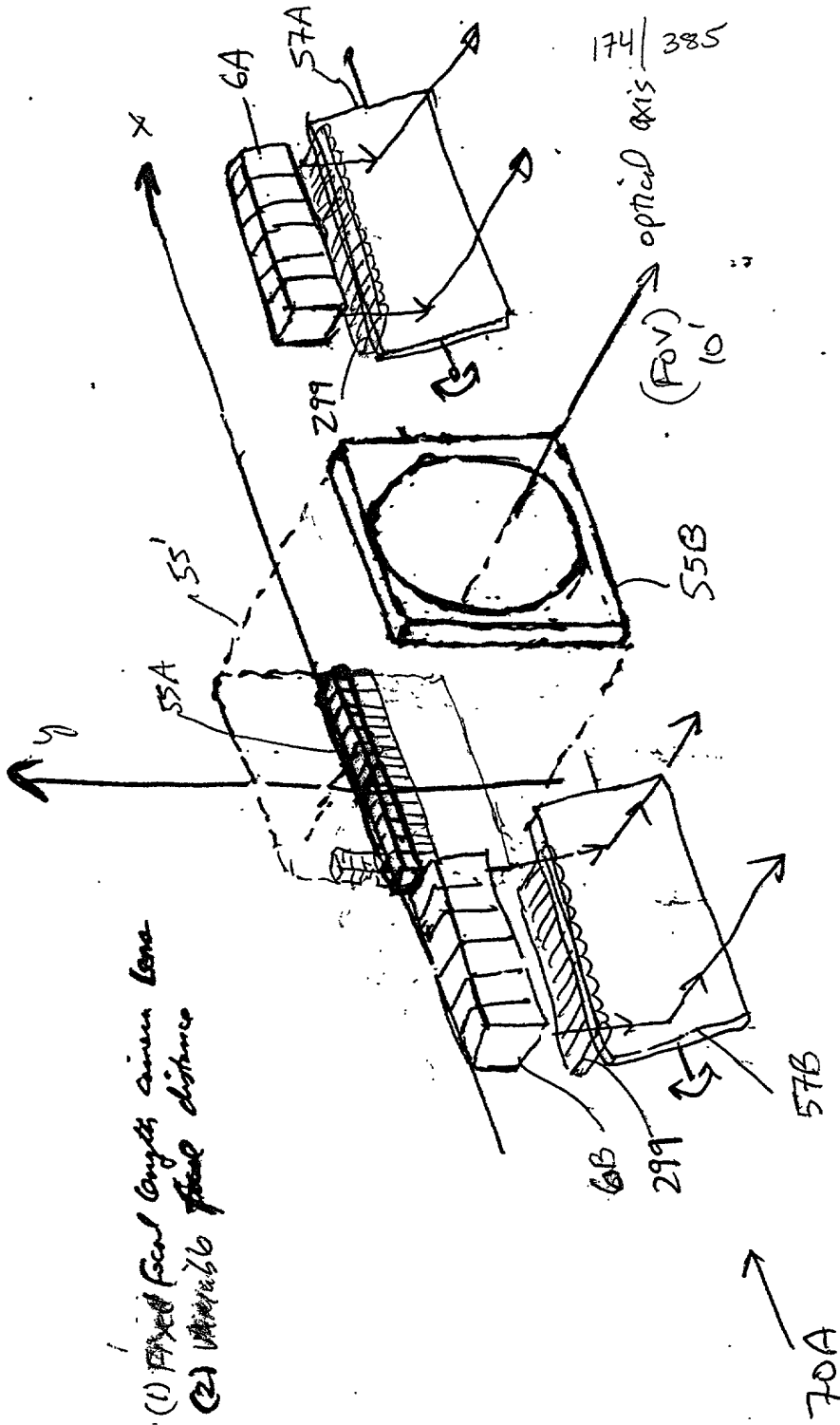


FIG. 5B2

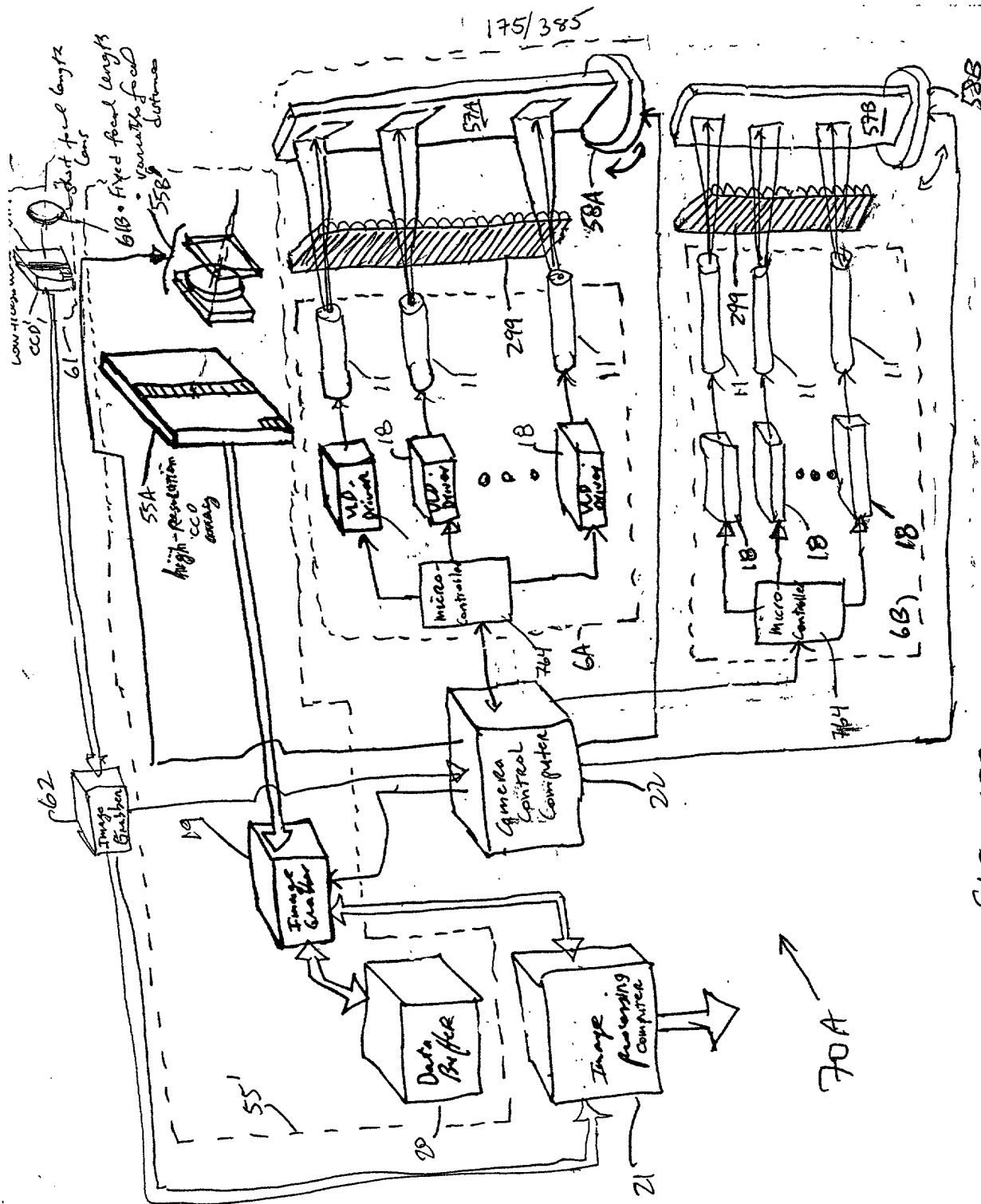


FIG. 5B3

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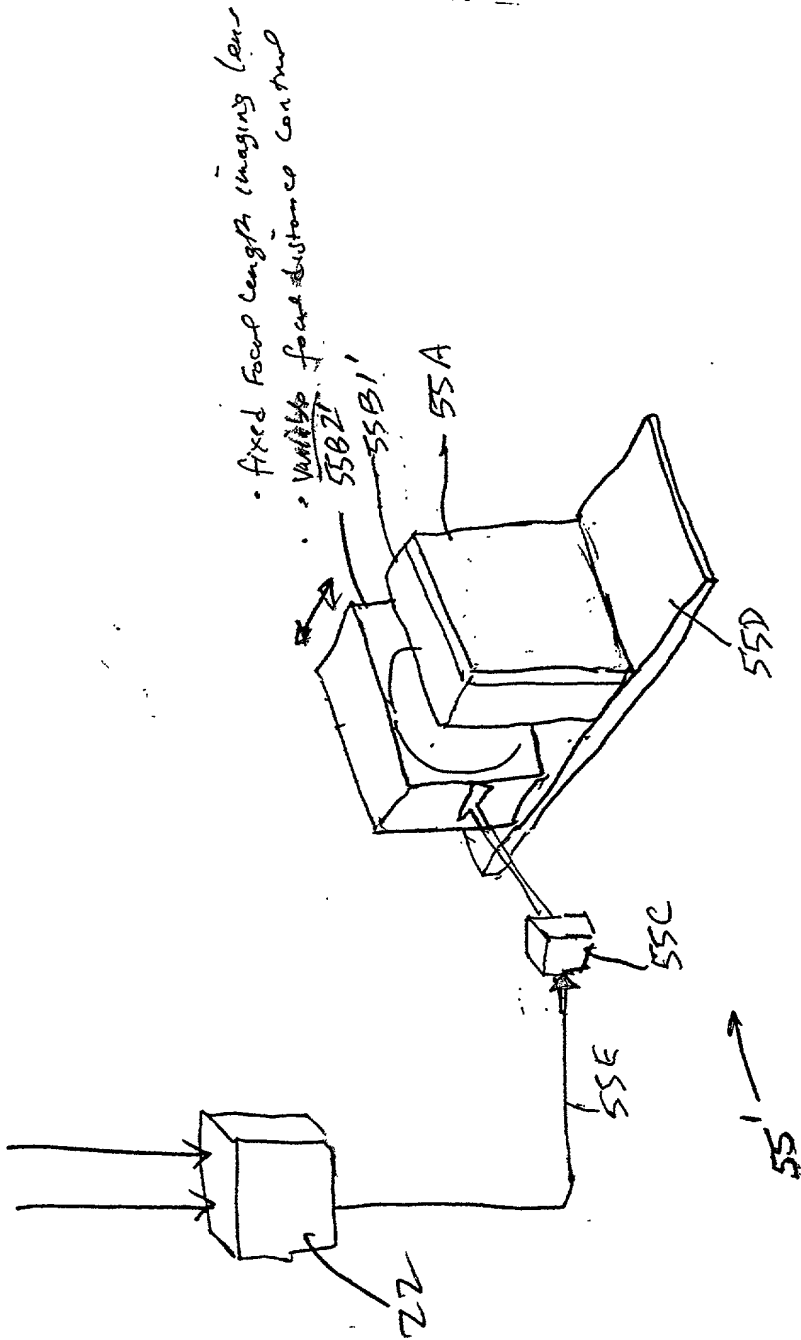


FIG. 5B4

Parameter	Unit	Value	Unit	Value	Unit	Value	Unit	Value
Mean	mm	1.0	mm	1.0	mm	1.0	mm	1.0
Standard deviation	mm	0.1	mm	0.1	mm	0.1	mm	0.1
Minimum	mm	0.8	mm	0.8	mm	0.8	mm	0.8
Maximum	mm	1.2	mm	1.2	mm	1.2	mm	1.2
Range	mm	0.4	mm	0.4	mm	0.4	mm	0.4
Median	mm	1.0	mm	1.0	mm	1.0	mm	1.0
Mode	mm	1.0	mm	1.0	mm	1.0	mm	1.0
Skewness		0.0		0.0		0.0		0.0
Kurtosis		0.0		0.0		0.0		0.0
Correlation coefficient		0.0		0.0		0.0		0.0
Chi-square		0.0		0.0		0.0		0.0
Degrees of freedom		0.0		0.0		0.0		0.0
P-value		0.0		0.0		0.0		0.0
Significance level		0.0		0.0		0.0		0.0
Confidence interval		0.0		0.0		0.0		0.0
Standard error		0.0		0.0		0.0		0.0
Test statistic		0.0		0.0		0.0		0.0
Acceptance region		0.0		0.0		0.0		0.0
Rejection region		0.0		0.0		0.0		0.0
Power of test		0.0		0.0		0.0		0.0
Effect size		0.0		0.0		0.0		0.0
Sample size		0.0		0.0		0.0		0.0
Population size		0.0		0.0		0.0		0.0
Response rate		0.0		0.0		0.0		0.0
Non-response rate		0.0		0.0		0.0		0.0
Dropout rate		0.0		0.0		0.0		0.0
Attrition rate		0.0		0.0		0.0		0.0
Completion rate		0.0		0.0		0.0		0.0
Refusal rate		0.0		0.0		0.0		0.0
Withdrawal rate		0.0		0.0		0.0		0.0
Eligibility rate		0.0		0.0		0.0		0.0
Ineligibility rate		0.0		0.0		0.0		0.0
Consent rate		0.0		0.0		0.0		0.0
Non-consent rate		0.0		0.0		0.0		0.0
Adherence rate		0.0		0.0		0.0		0.0
Non-adherence rate		0.0		0.0		0.0		0.0
Compliance rate		0.0		0.0		0.0		0.0
Non-compliance rate		0.0		0.0		0.0		0.0
Retention rate		0.0		0.0		0.0		0.0
Dropout rate		0.0		0.0		0.0		0.0
Attrition rate		0.0		0.0		0.0		0.0
Completion rate		0.0		0.0		0.0		0.0
Refusal rate		0.0		0.0		0.0		0.0
Withdrawal rate		0.0		0.0		0.0		0.0
Eligibility rate		0.0		0.0		0.0		0.0
Ineligibility rate		0.0		0.0		0.0		0.0
Consent rate		0.0		0.0		0.0		0.0
Non-consent rate		0.0		0.0		0.0		0.0
Adherence rate		0.0		0.0		0.0		0.0
Non-adherence rate		0.0		0.0		0.0		0.0
Compliance rate		0.0		0.0		0.0		0.0
Non-compliance rate		0.0		0.0		0.0		0.0
Retention rate		0.0		0.0		0.0		0.0
Dropout rate		0.0		0.0		0.0		0.0
Attrition rate		0.0		0.0		0.0		0.0
Completion rate								



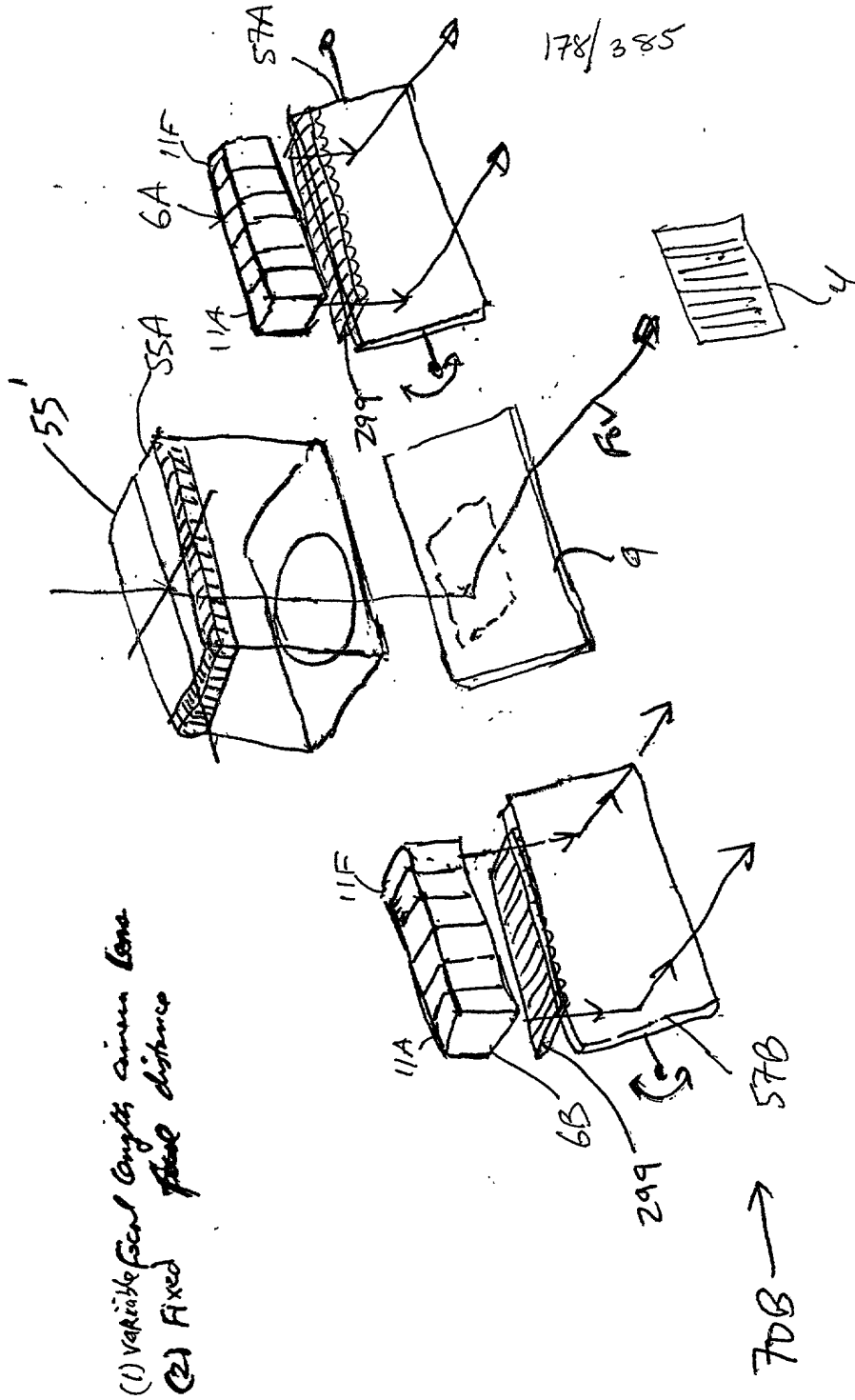


FIG. 5C

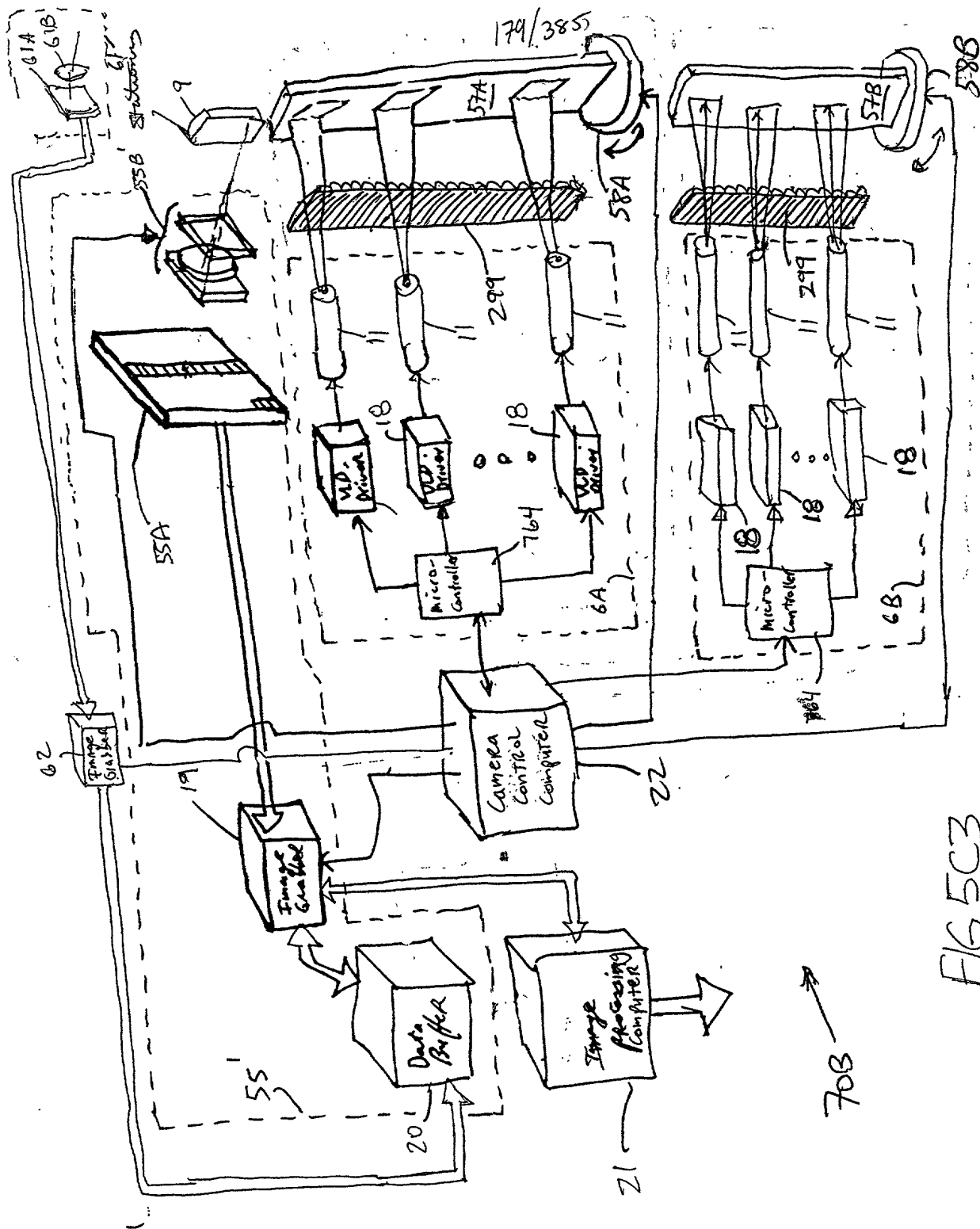


FIG. 5C3

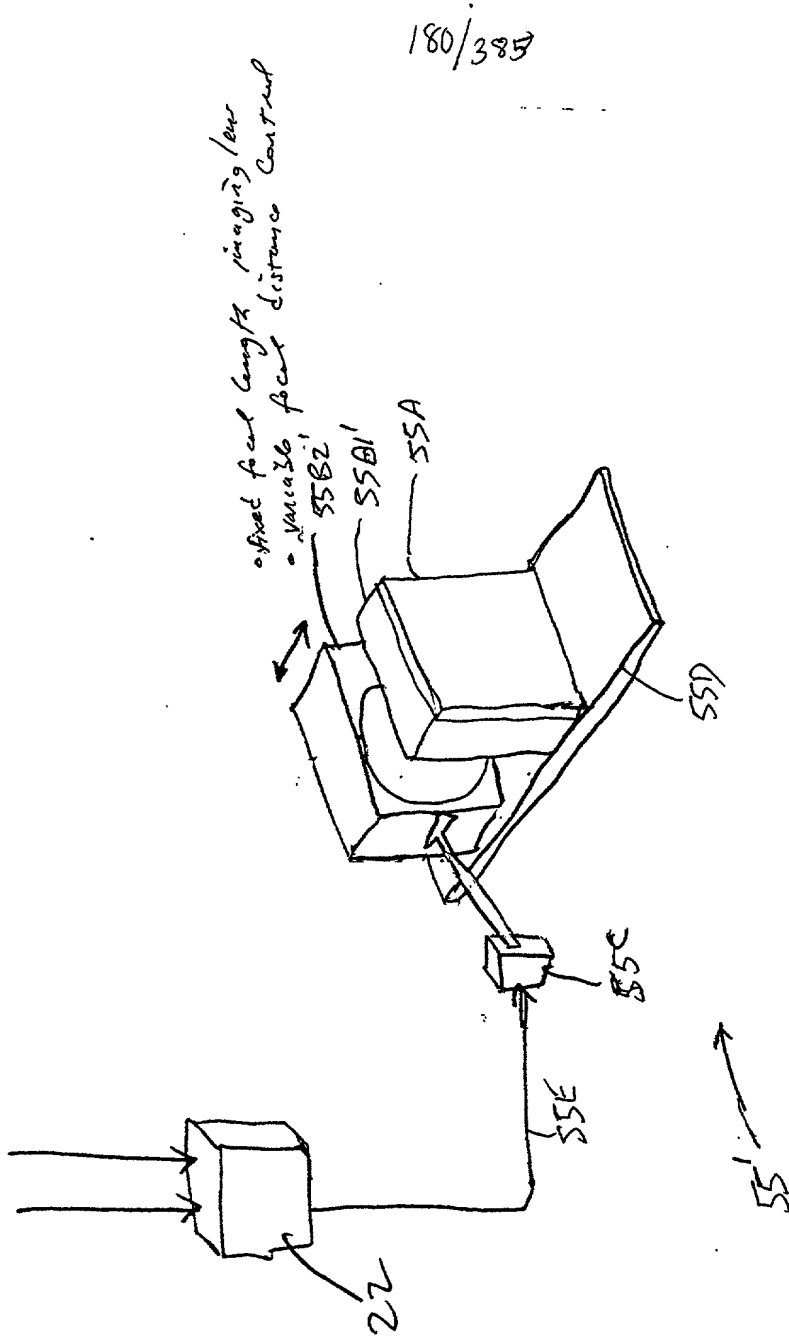


FIG. 5C4

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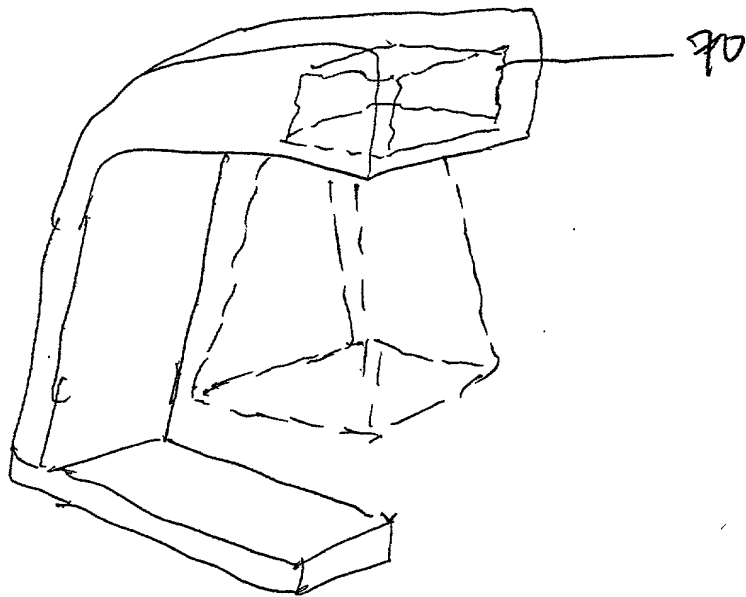


FIG. 5D

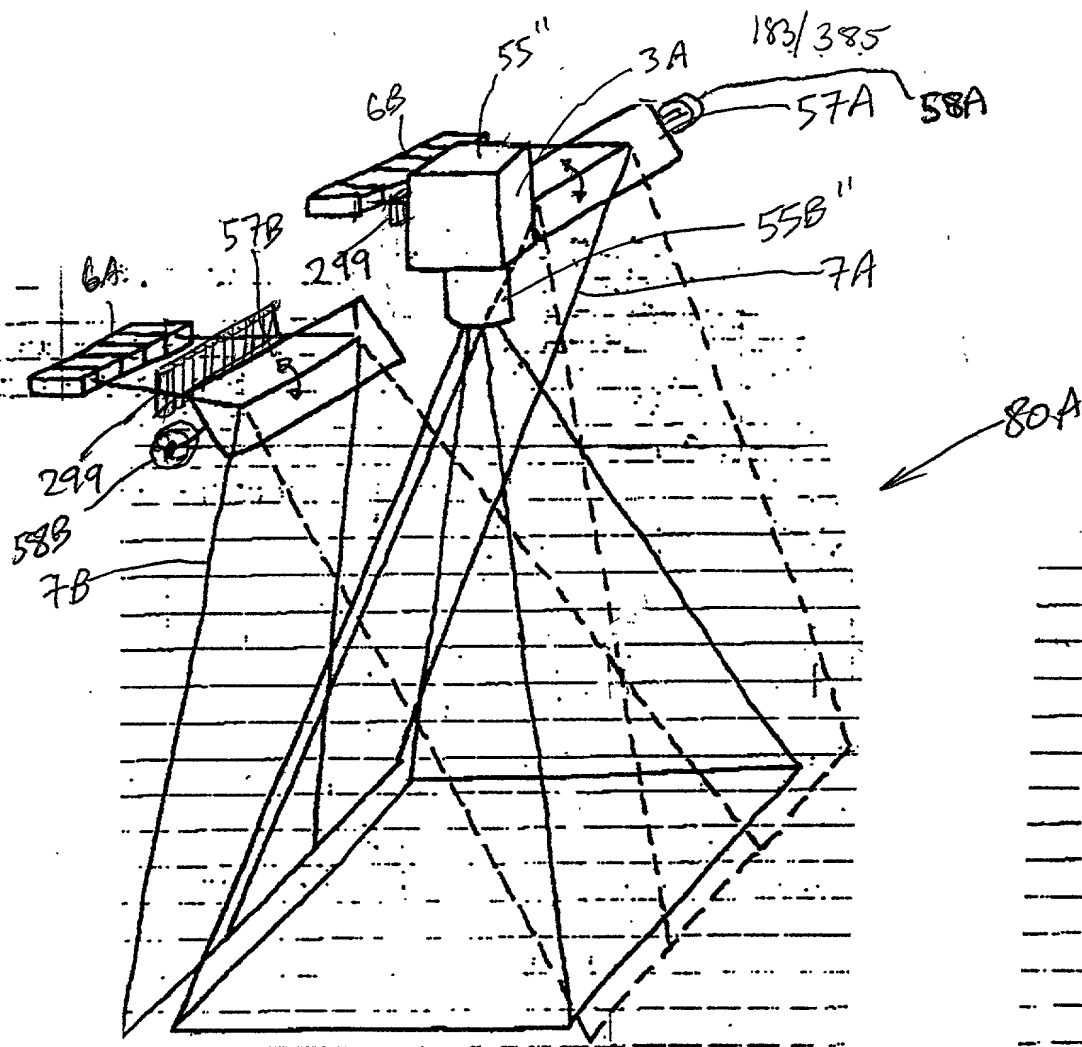
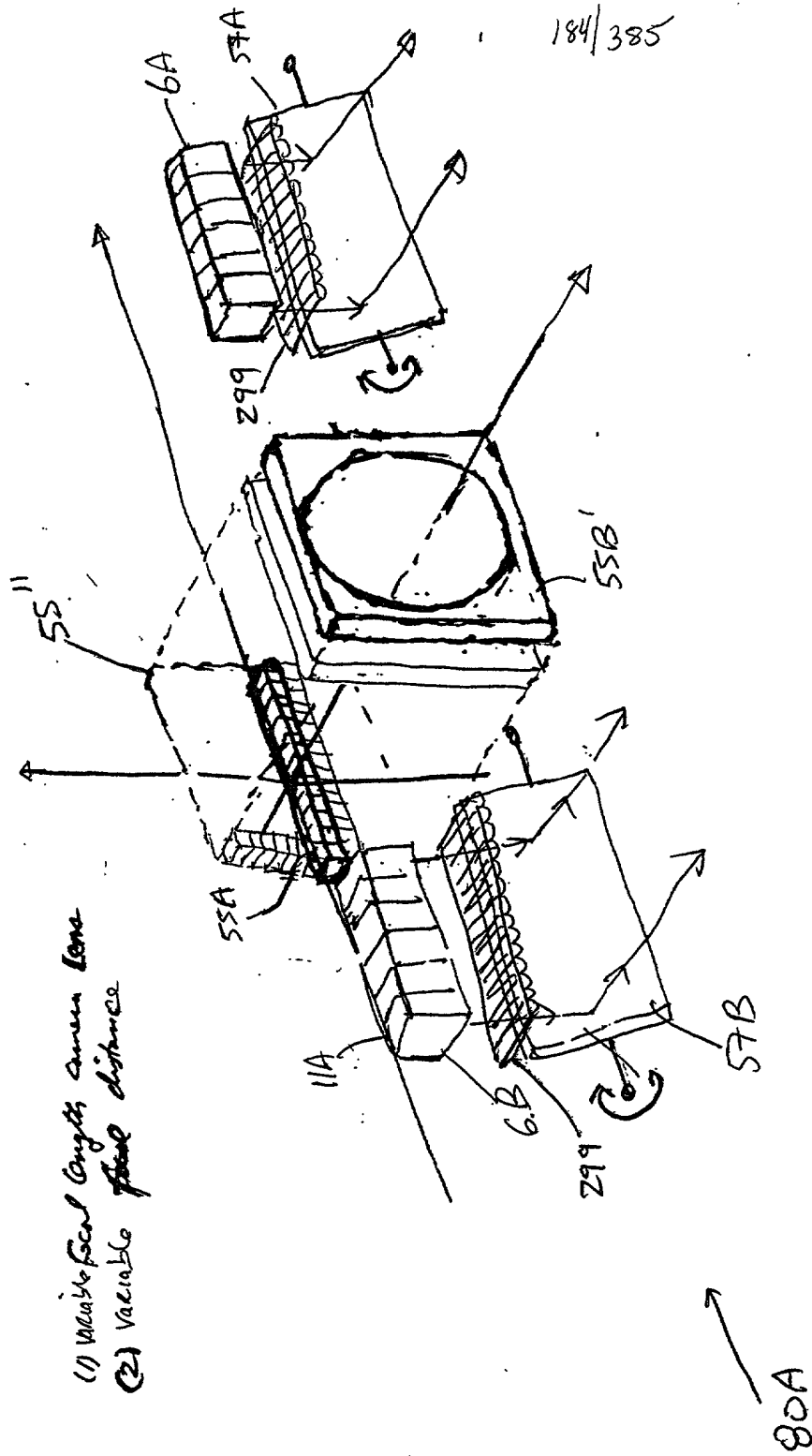


FIG. 6B1



(1) Variable focal length lens
(2) Variable focal distance

FIG. 6B2

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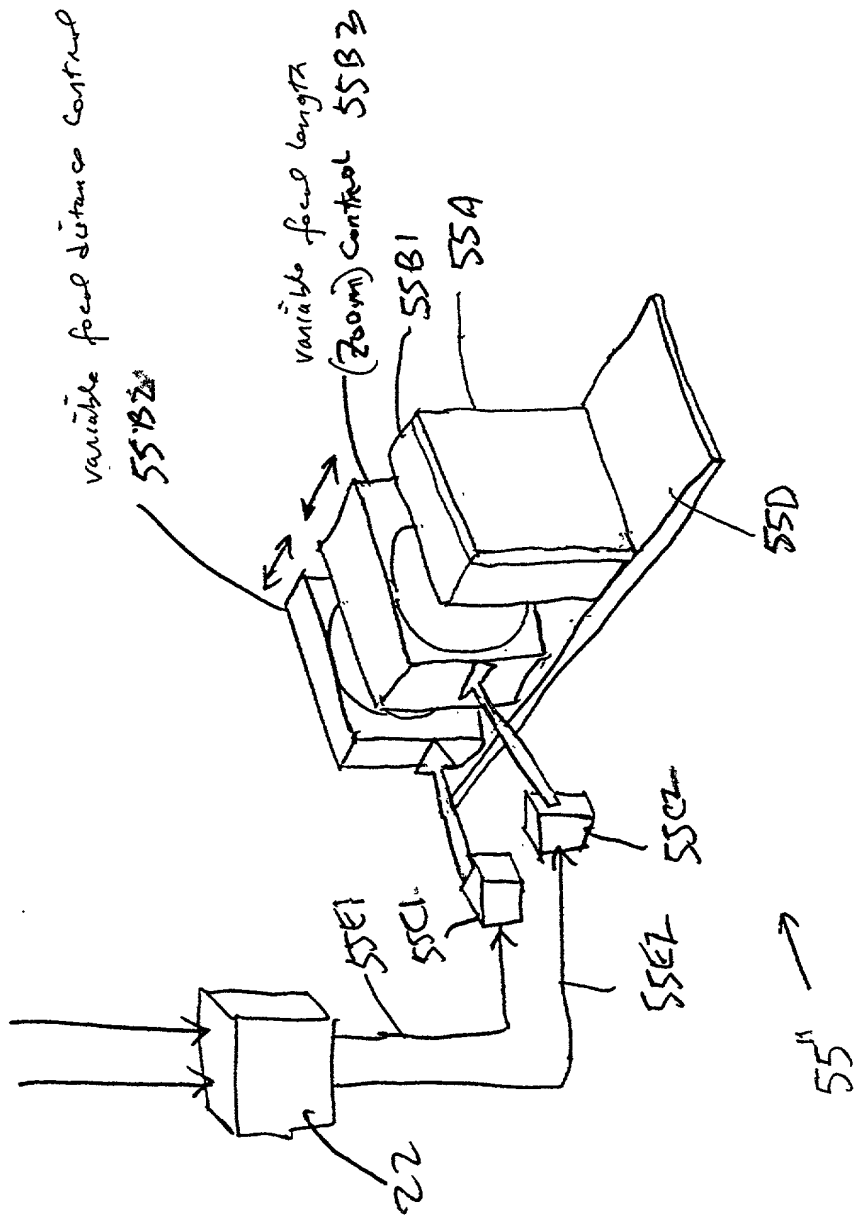


FIG. 6B4

0000585 442401

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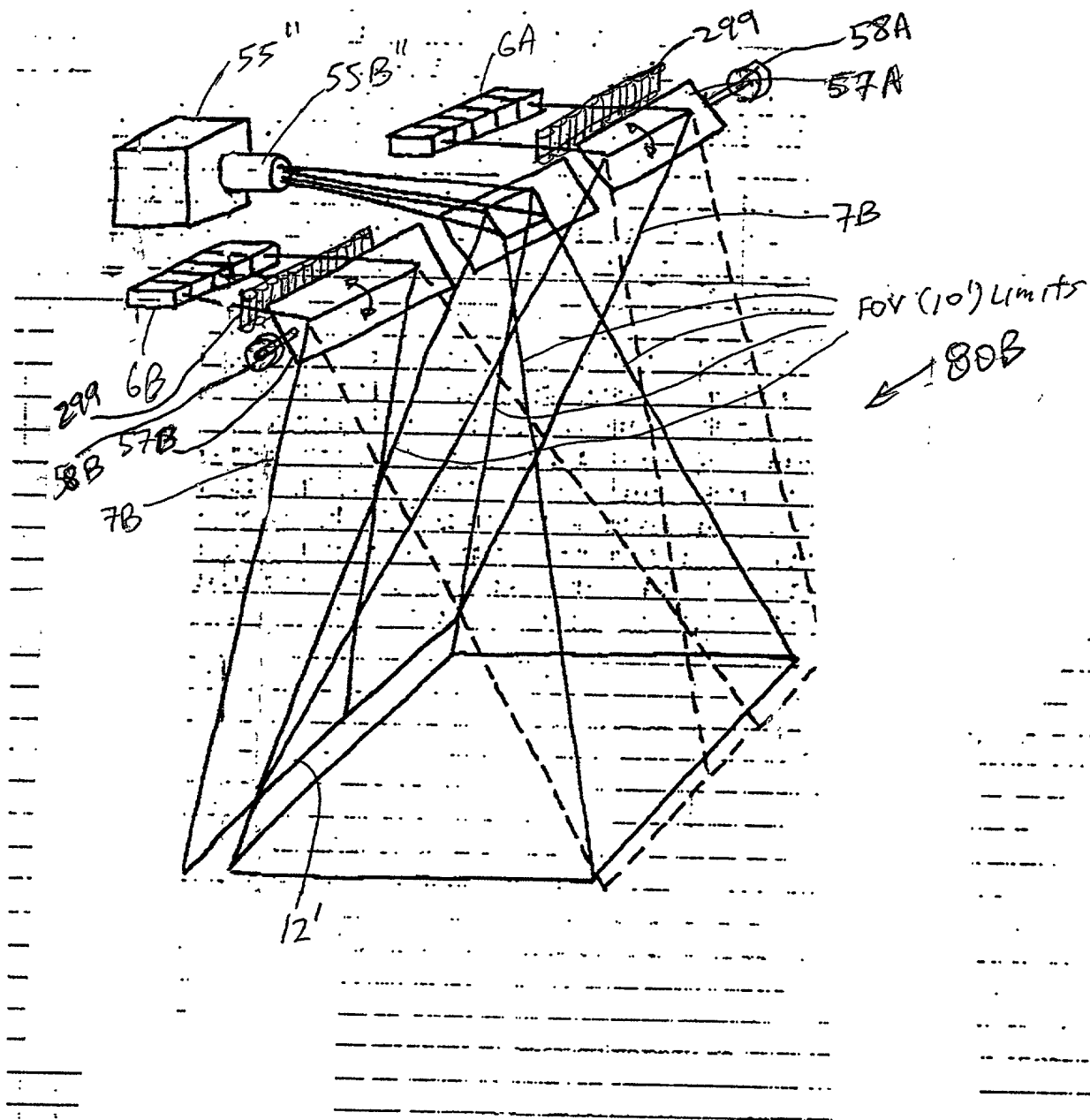
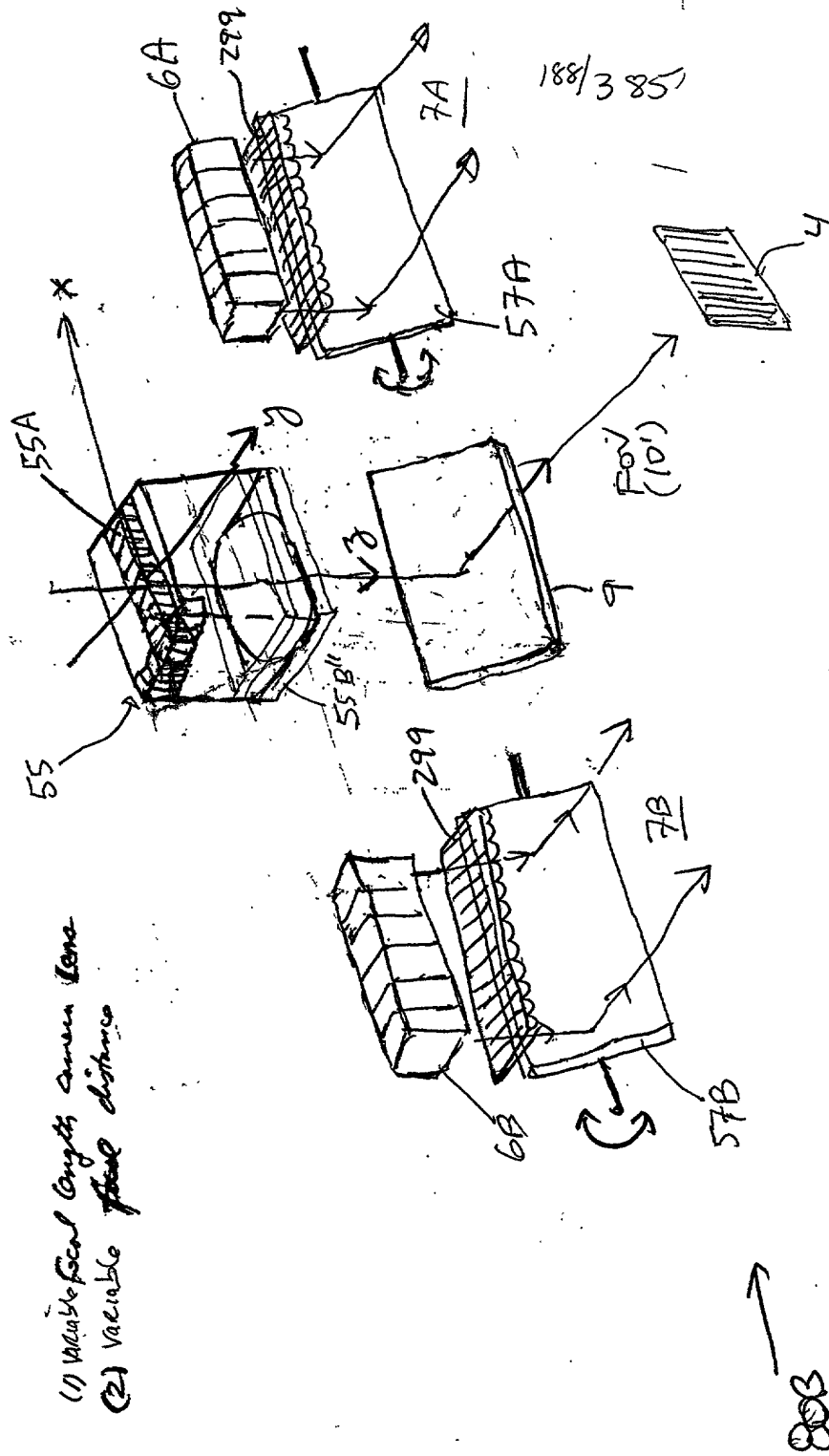
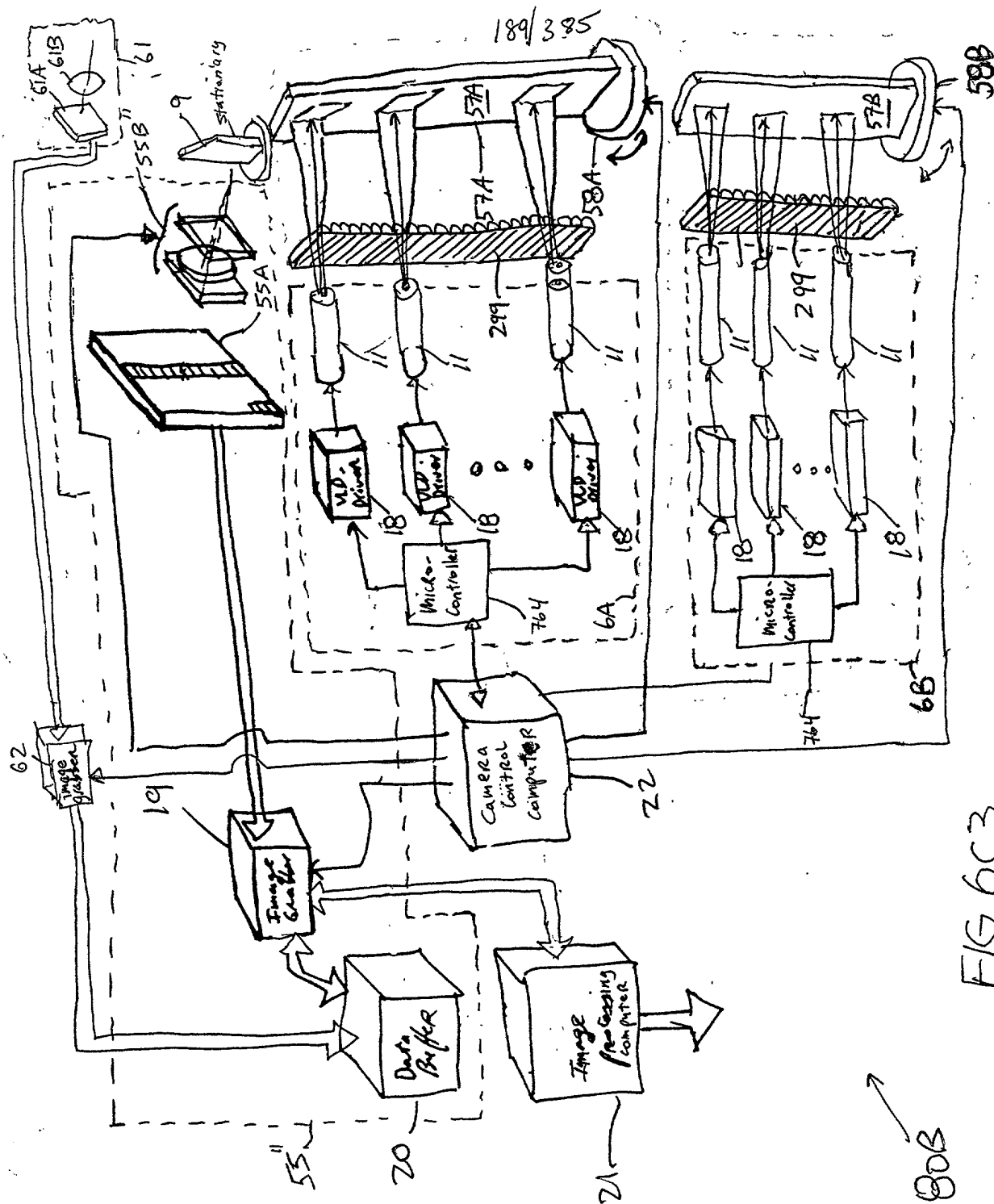


FIG. 6C1





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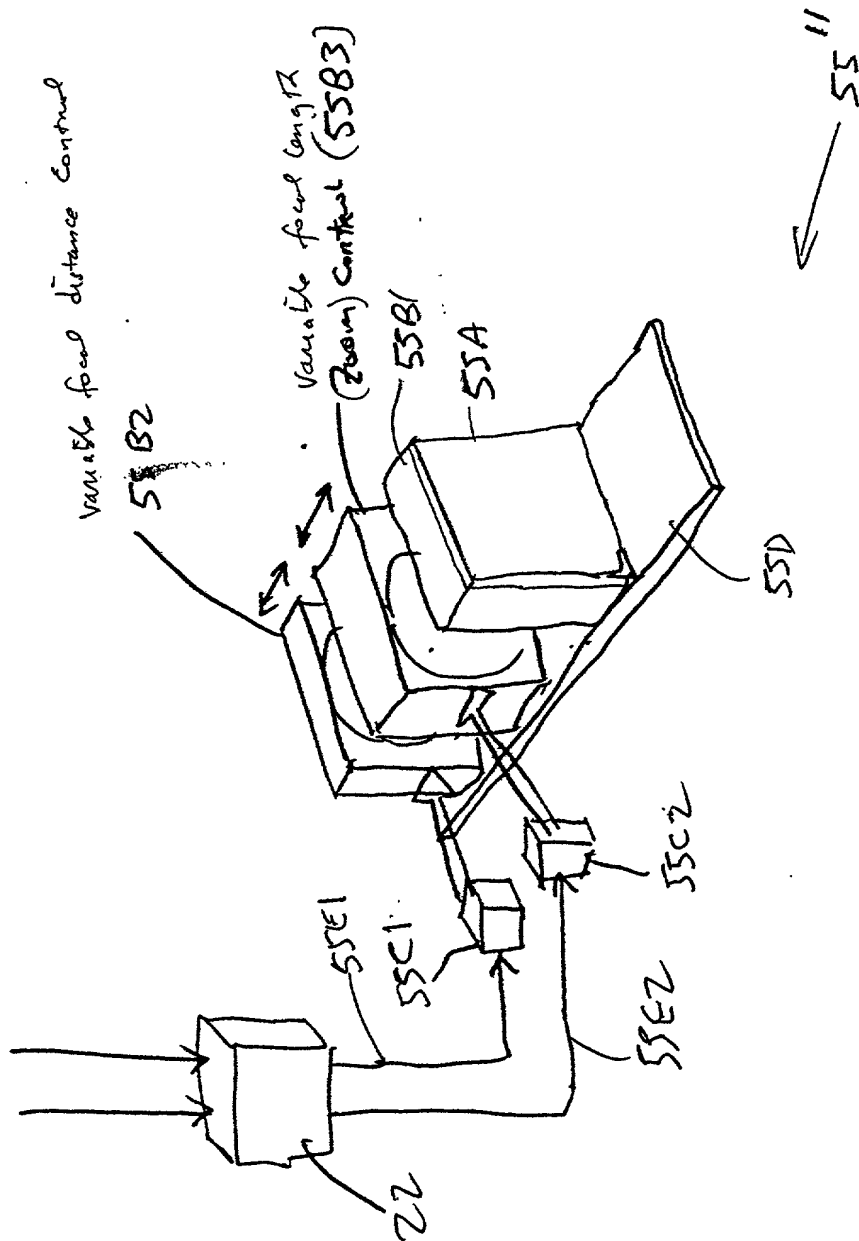


FIG. 6C4

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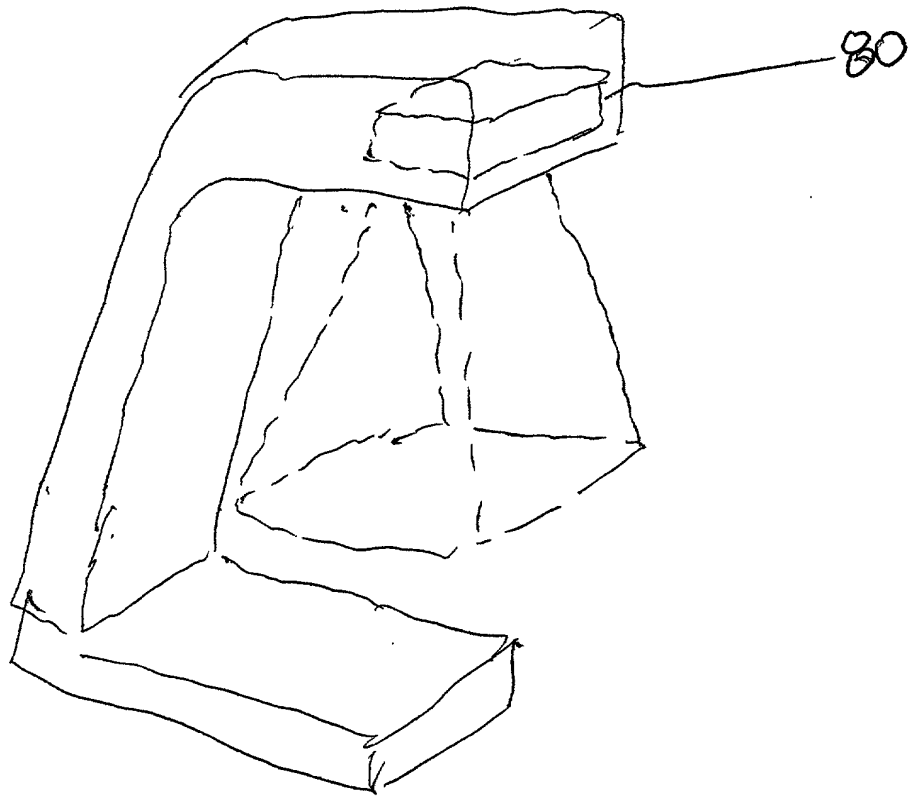


FIG. 6C5

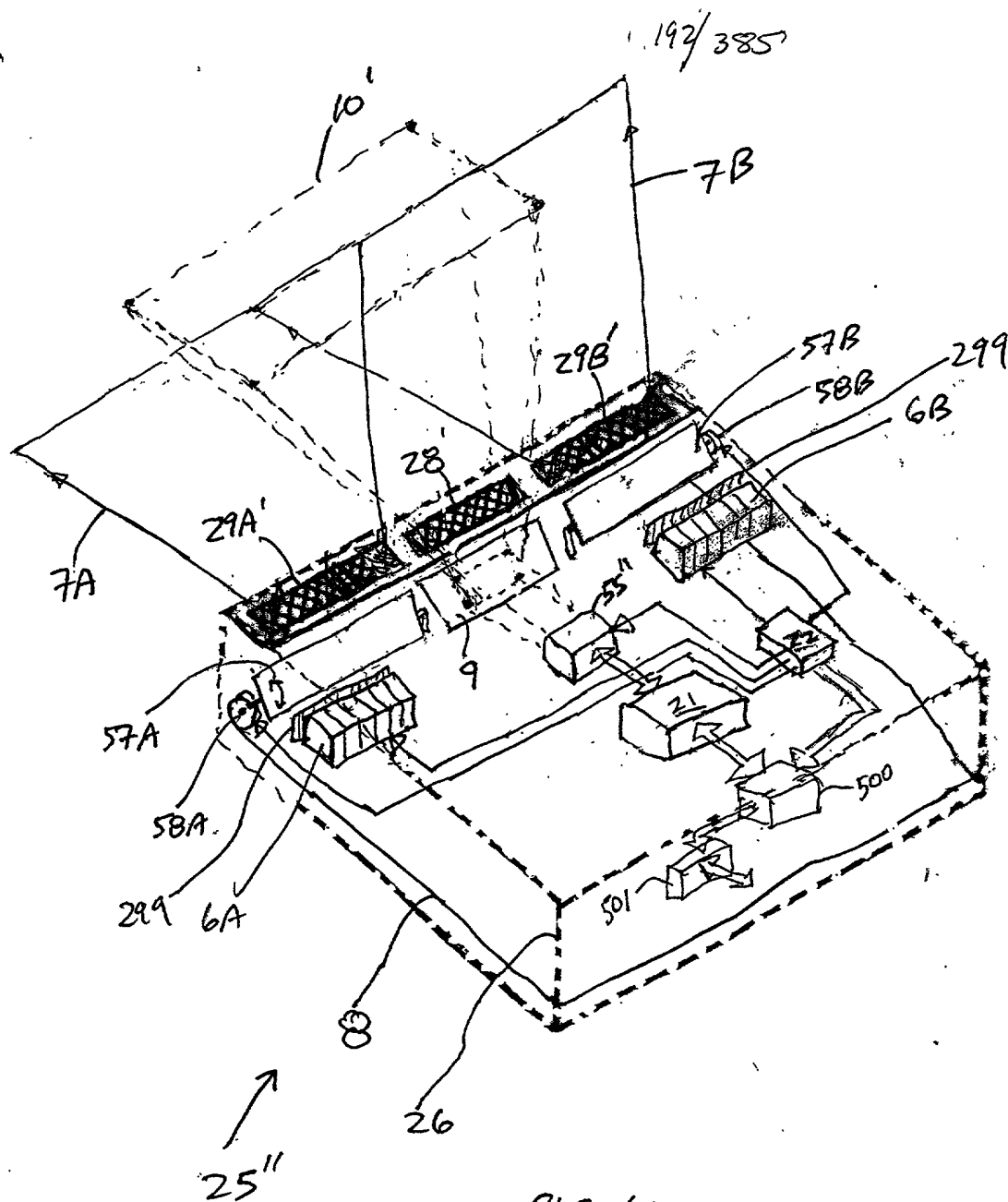
[illegible]

FIG. 6D1

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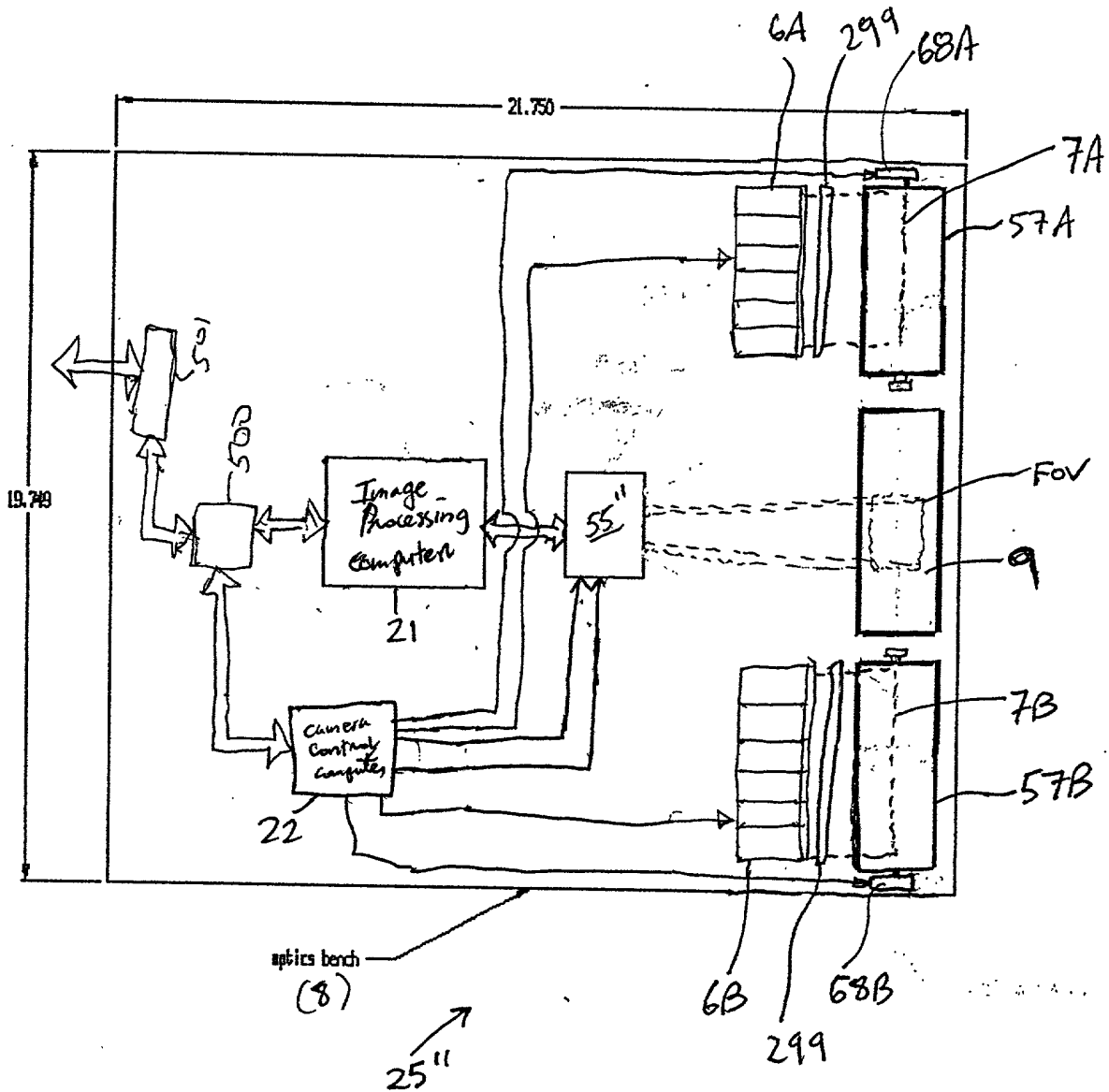
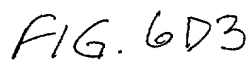


FIG. 6DZ

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2
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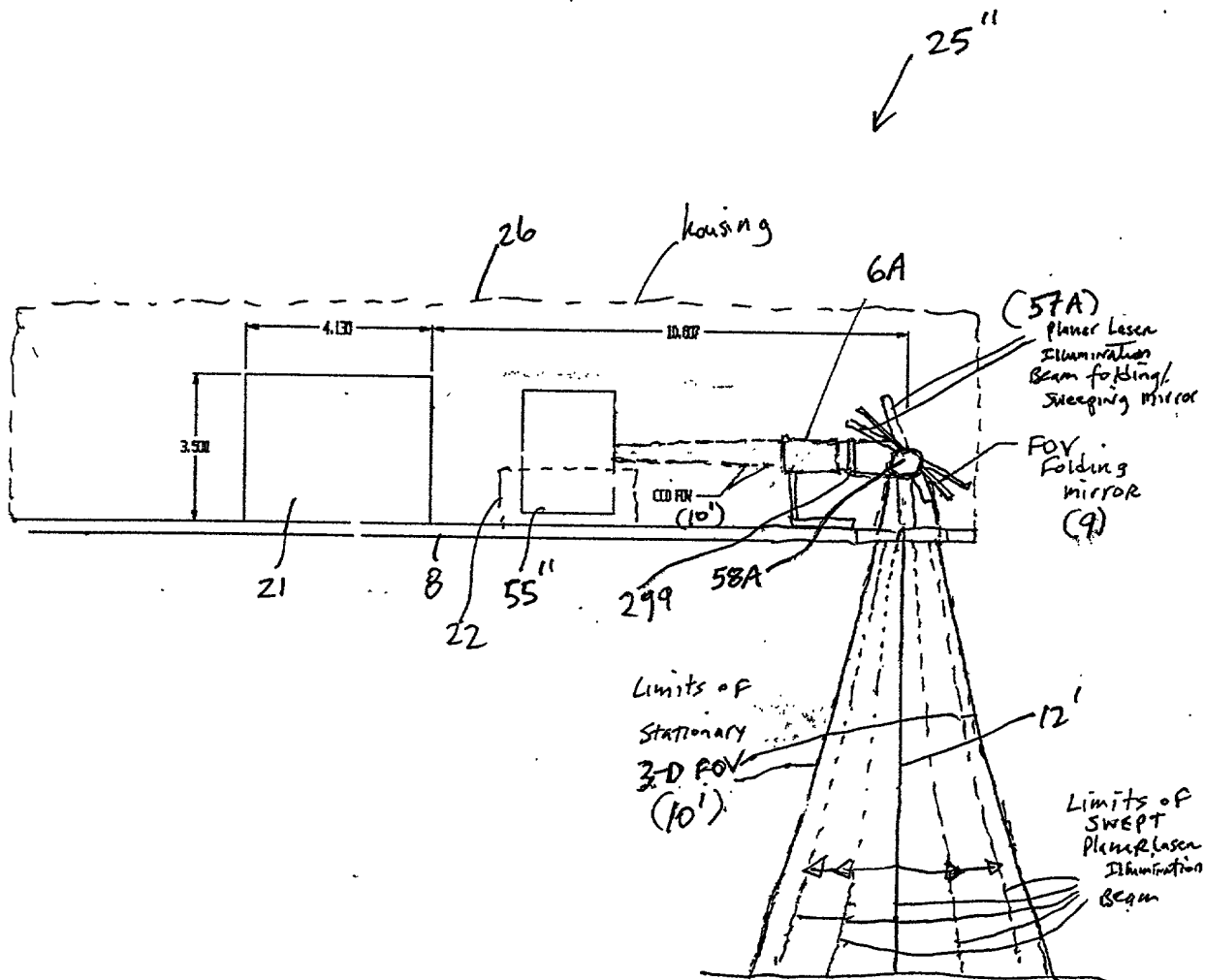


FIG. 6D4

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variable FOV

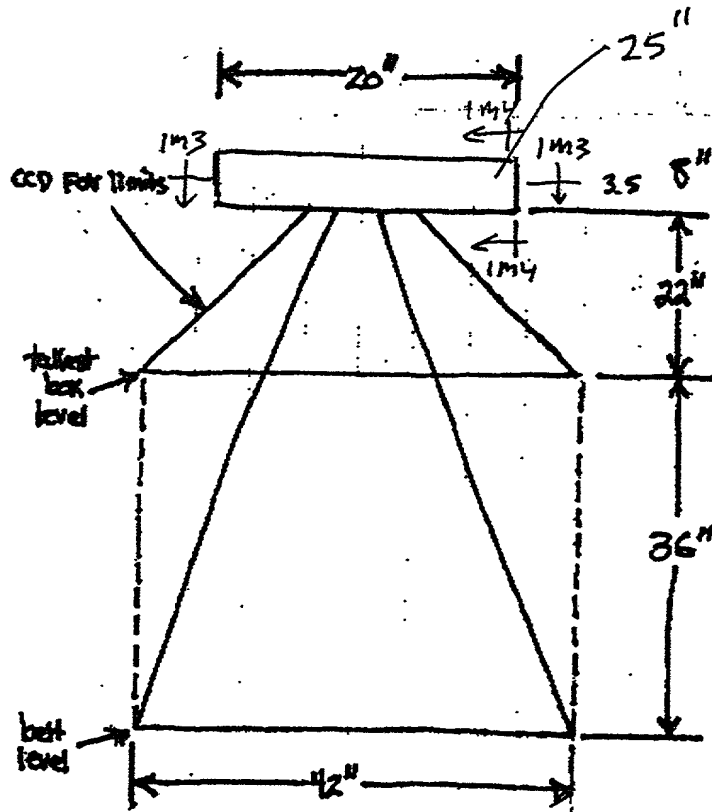
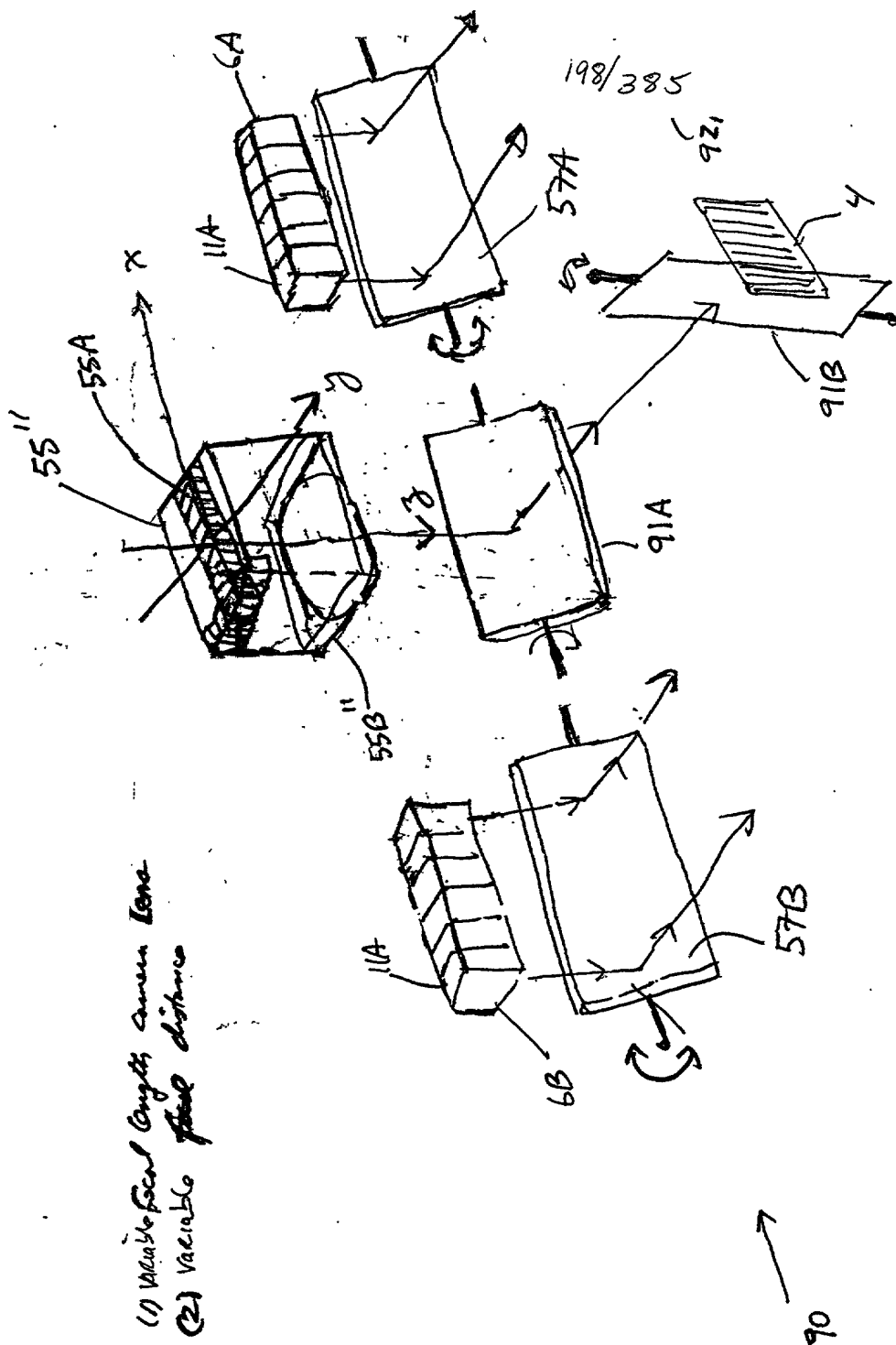


FIG. 6D5

0114

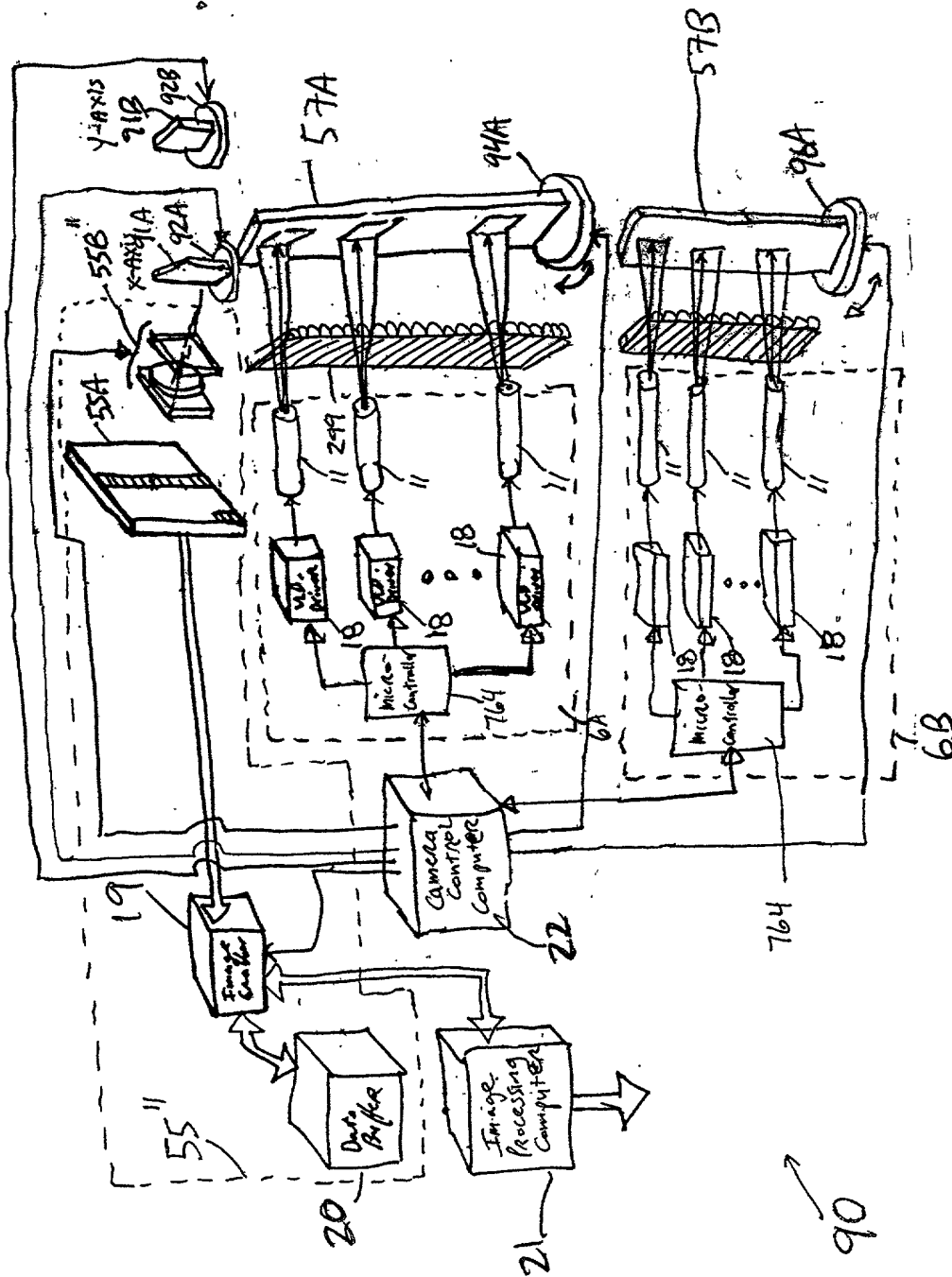
0090585-1140

0114

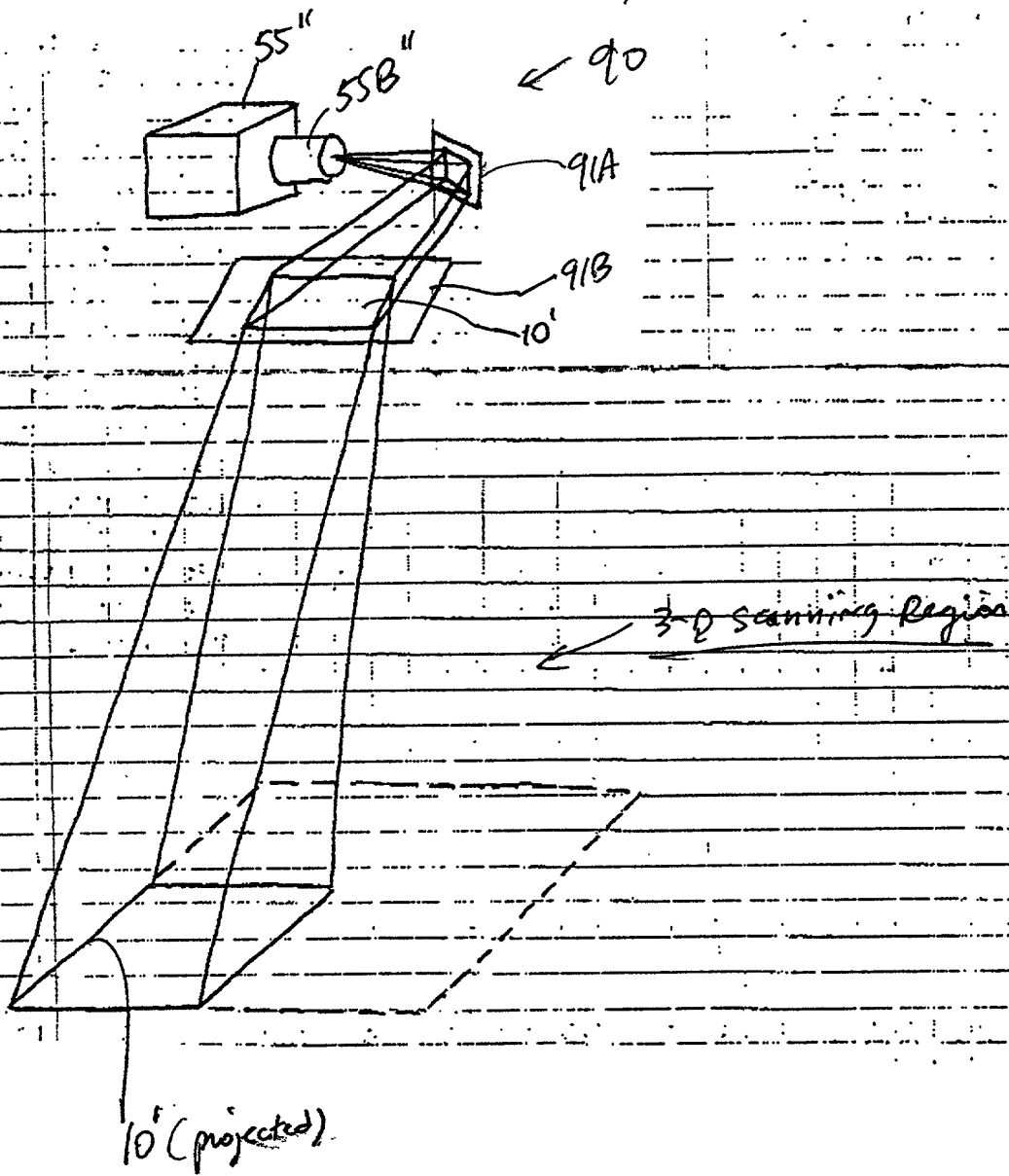


(1) Variable focal length, convex lens
(2) Variable fluid distance

FIG. 6E2



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— FIG. 6E4

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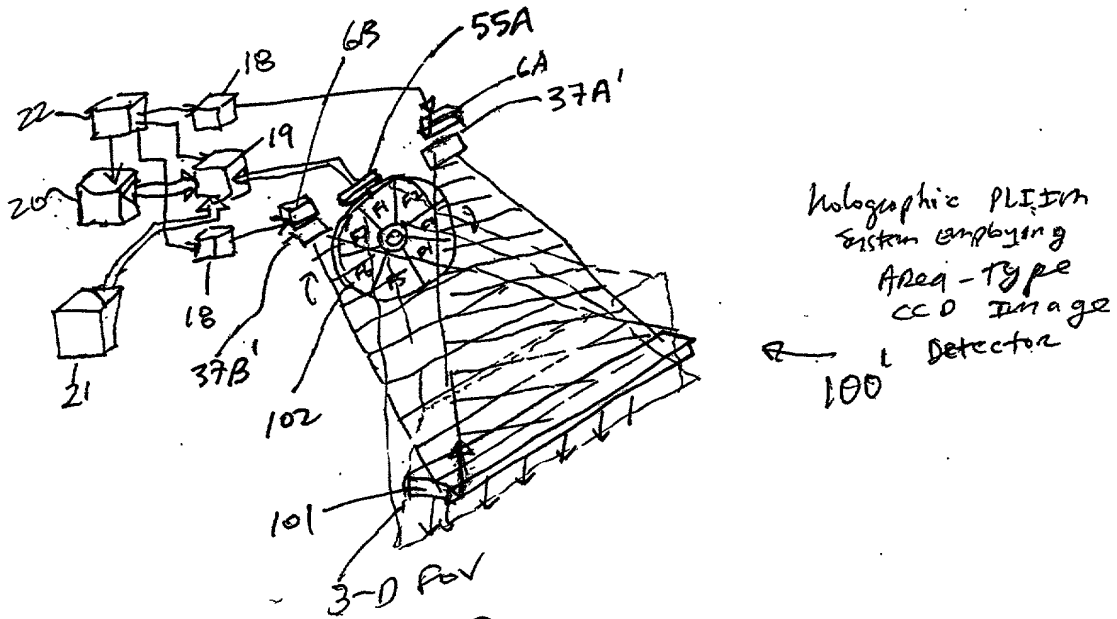


FIG. 8A

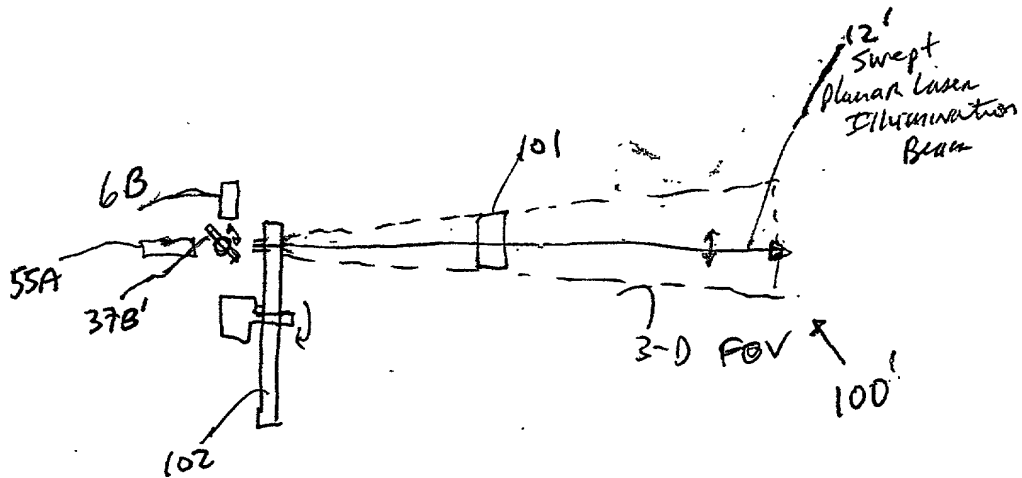


FIG. 8B

0000055 142104

1-D CCD SCANNER EMBODIMENT

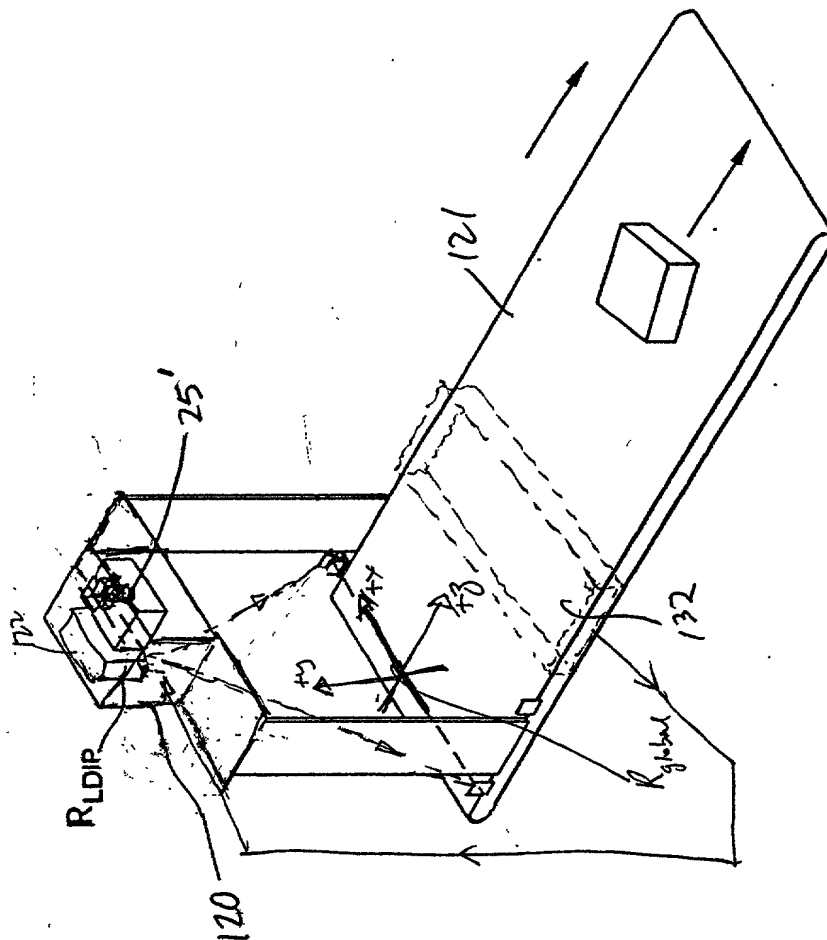
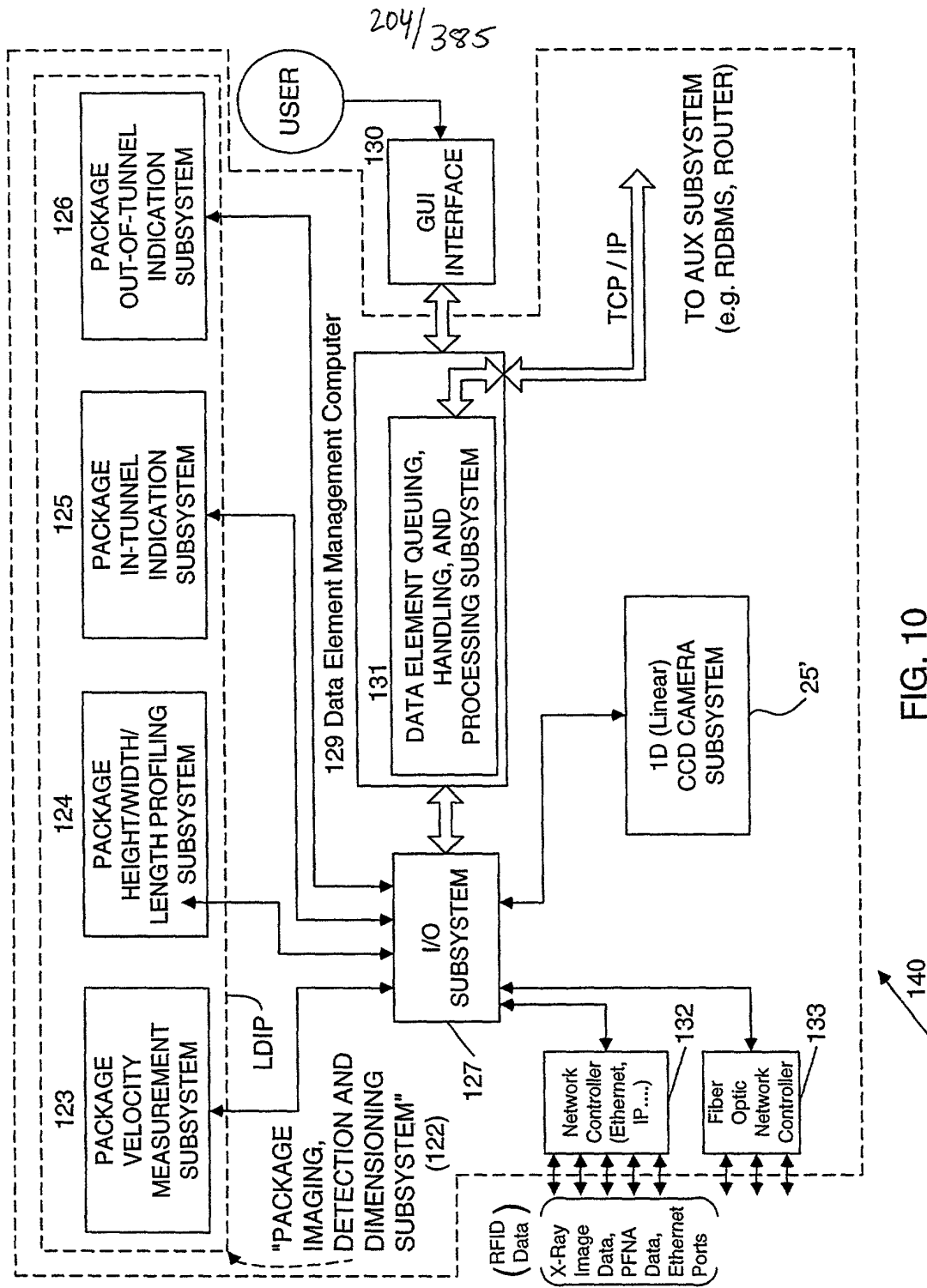


FIG. 9



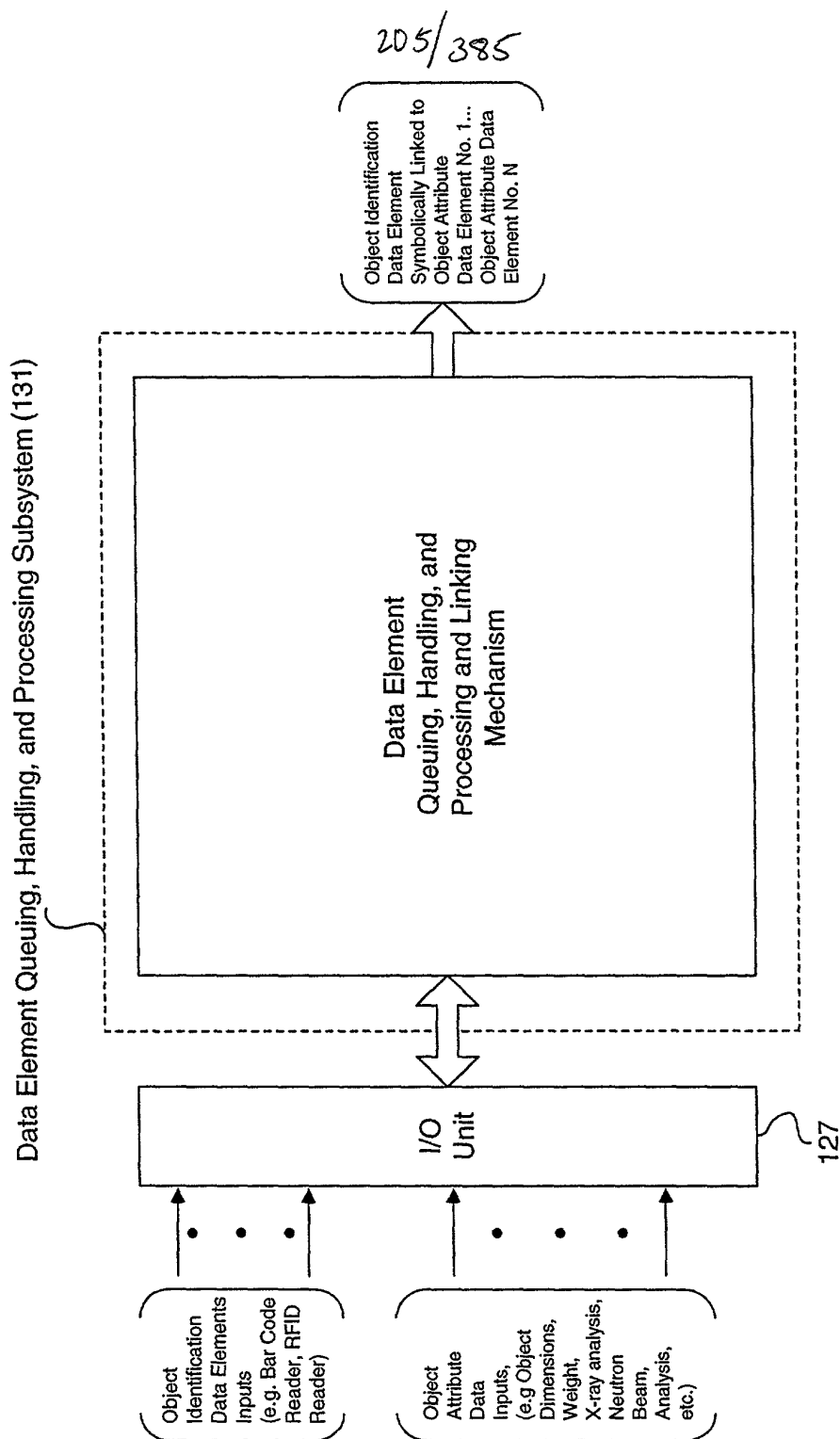
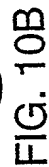


FIG. 10A

A. Specification of Object Detection and Tracking Capability of System

B. Specification of Object Identification Capability of System

C. Specification of Object Attribute Acquisition Capability of System



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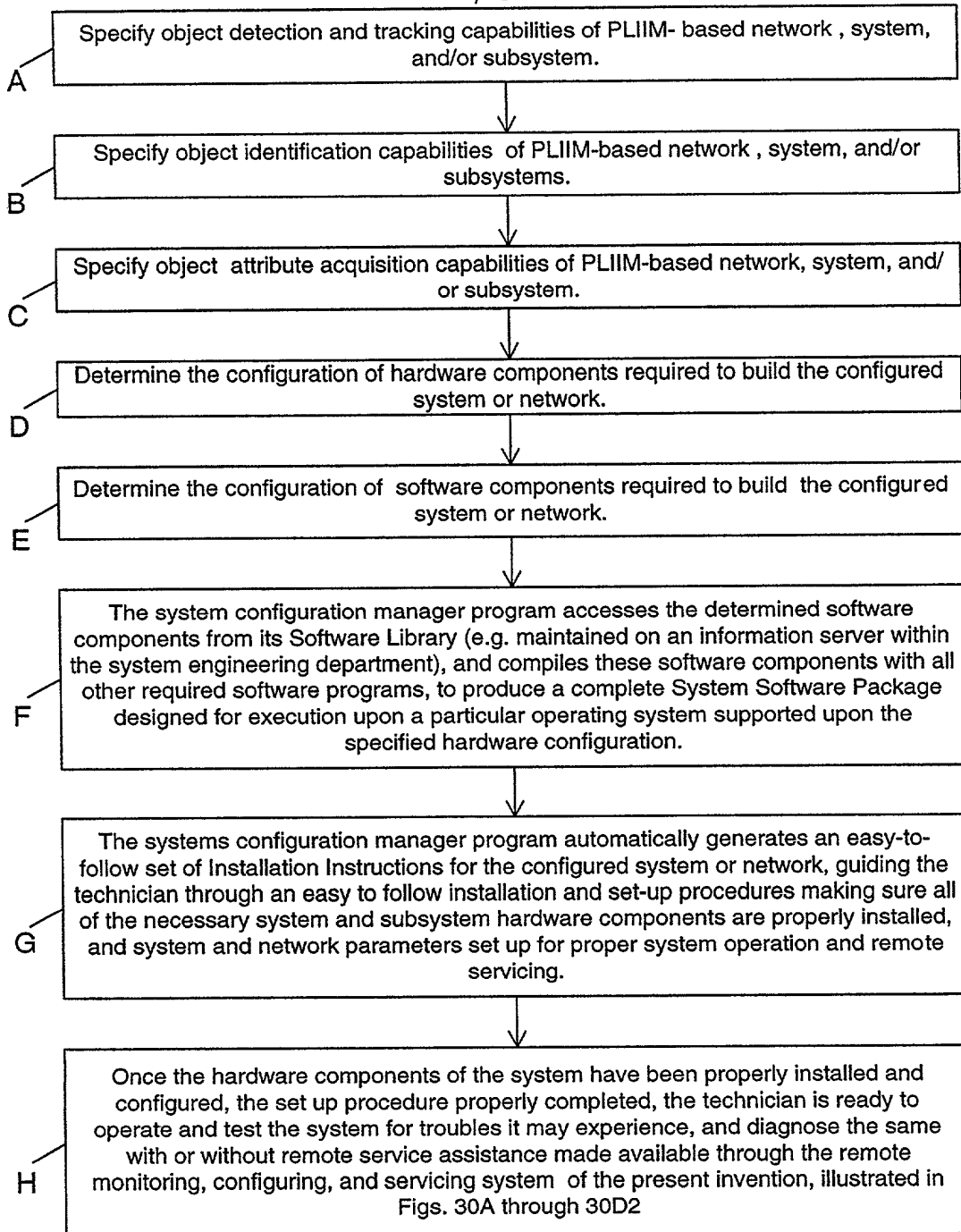


FIG. 10C

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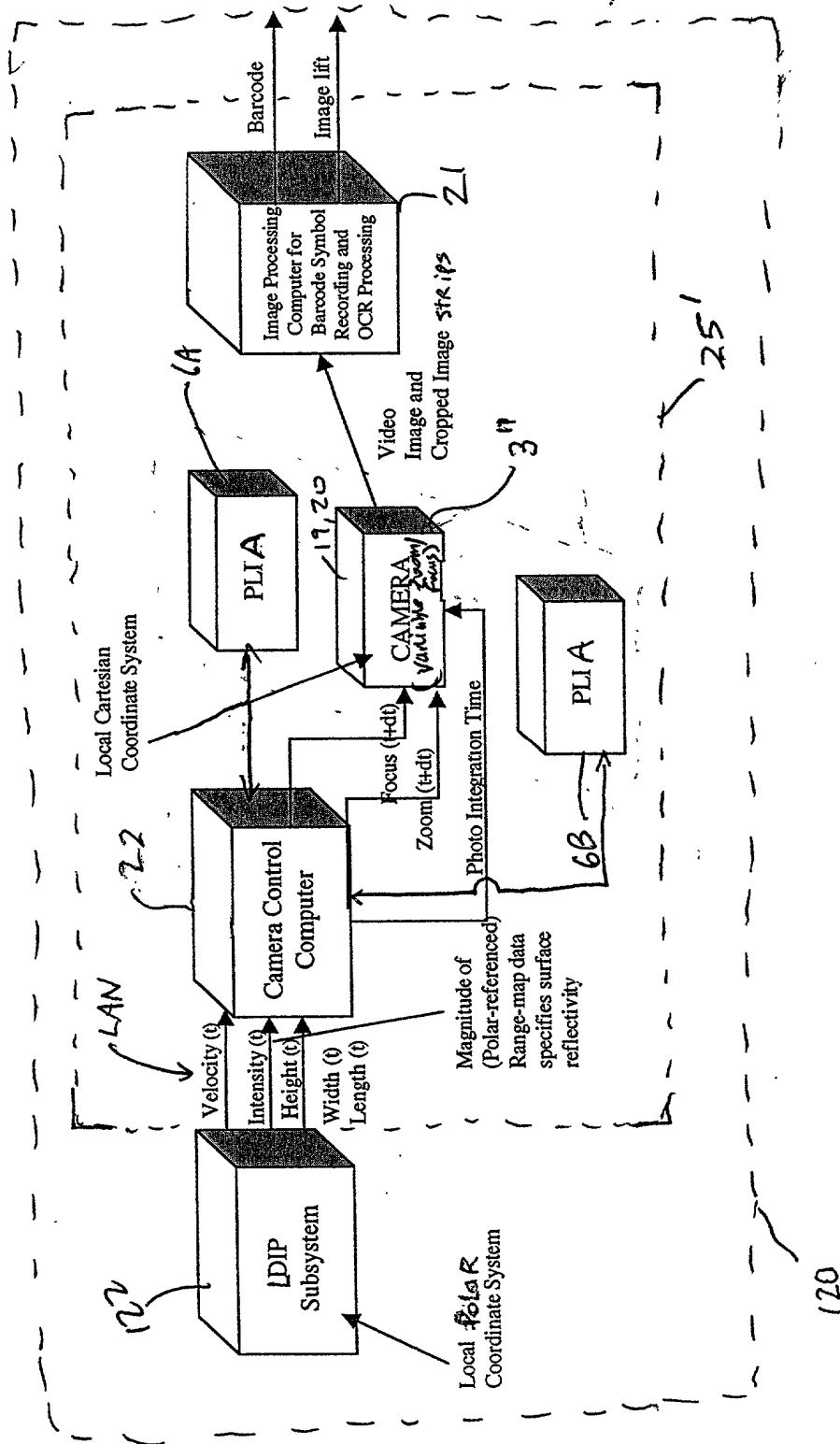
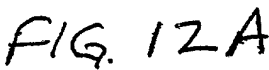


FIG. 11

[illegible]

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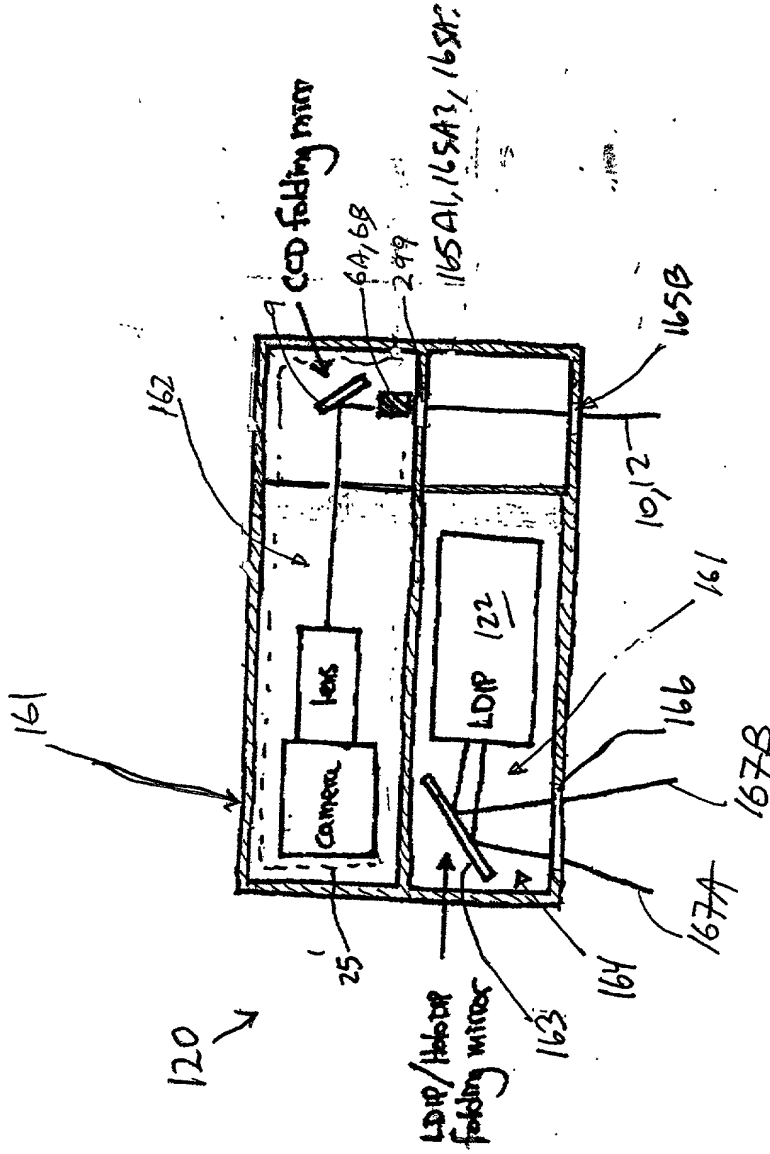


FIG. 12B

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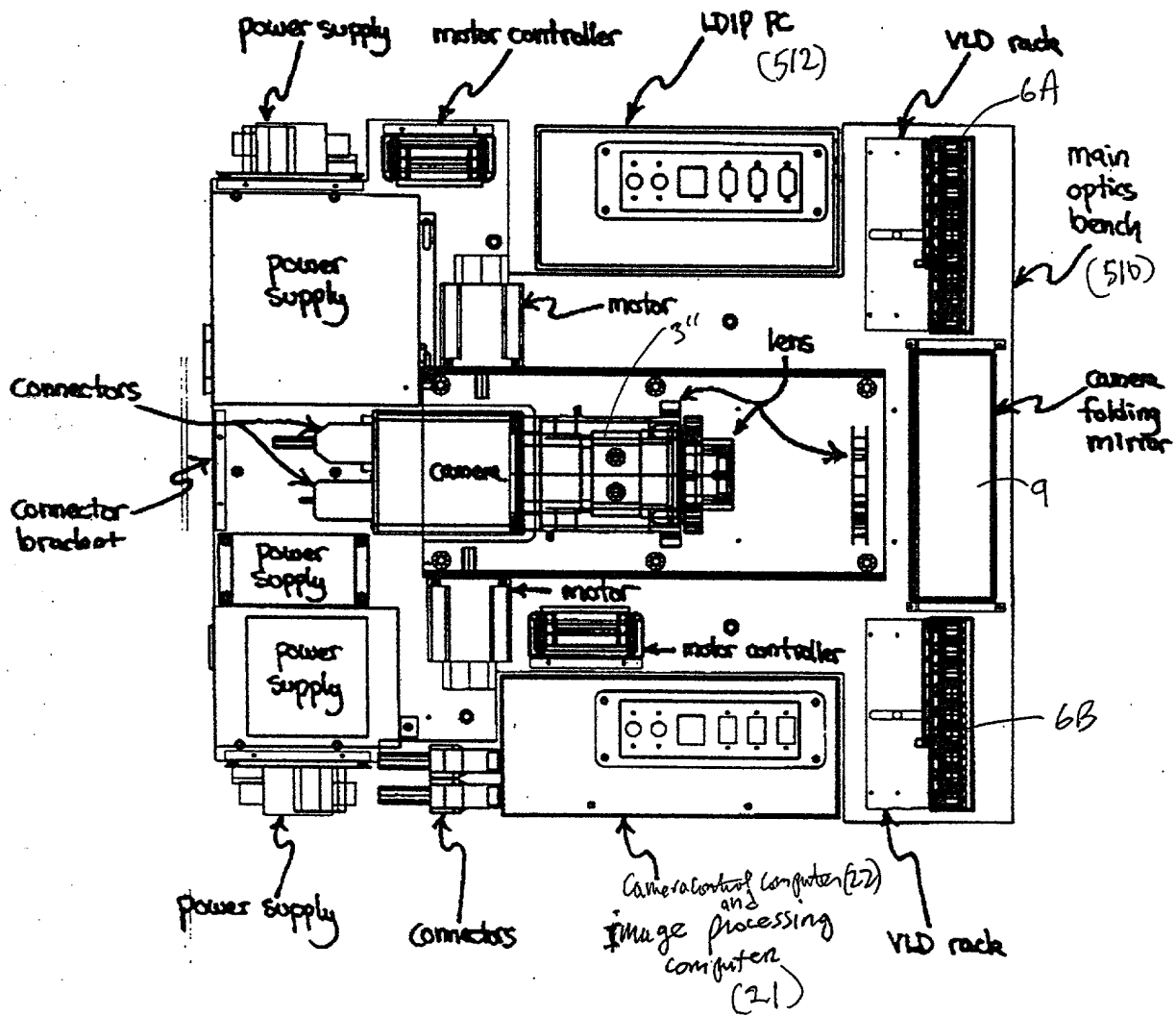


FIG. 12C

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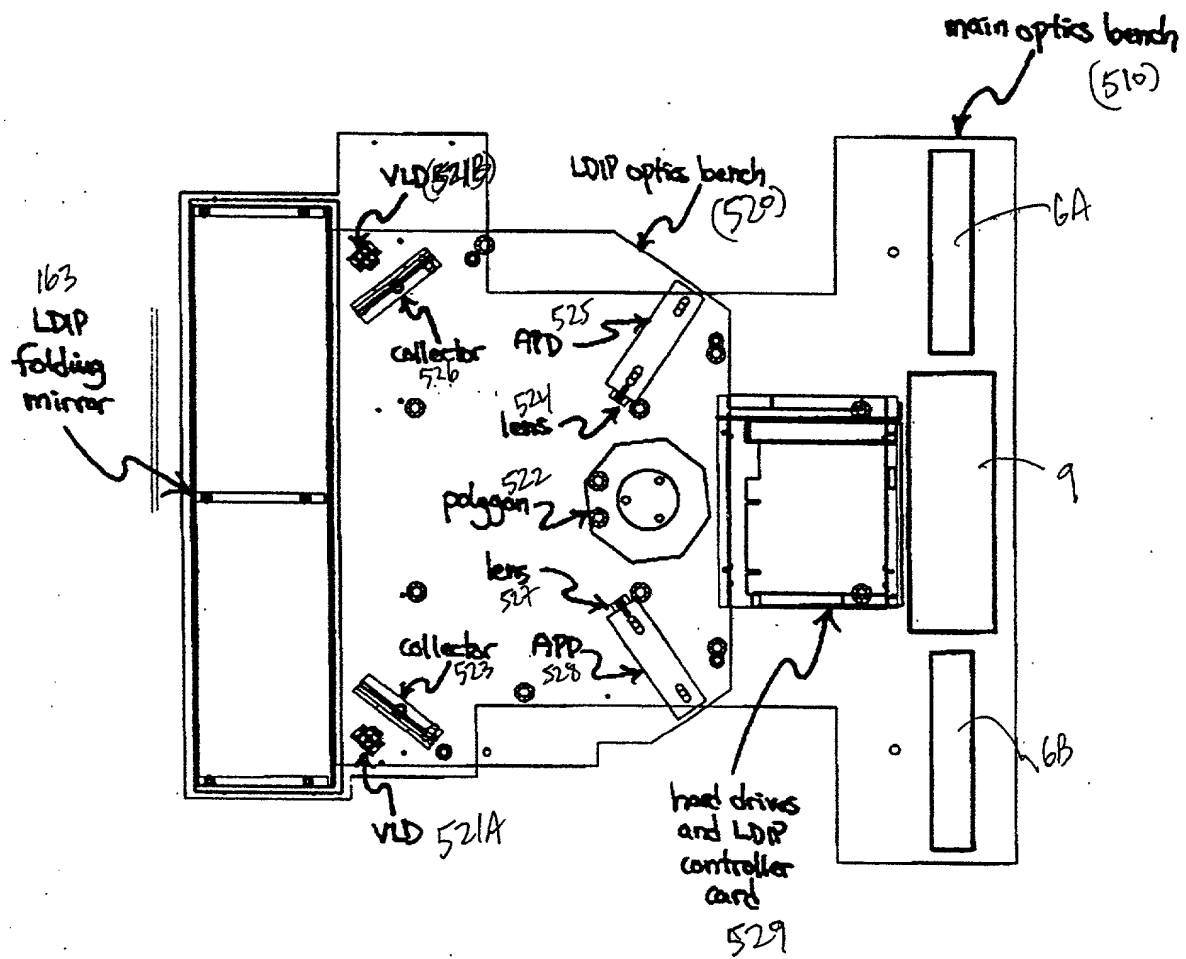
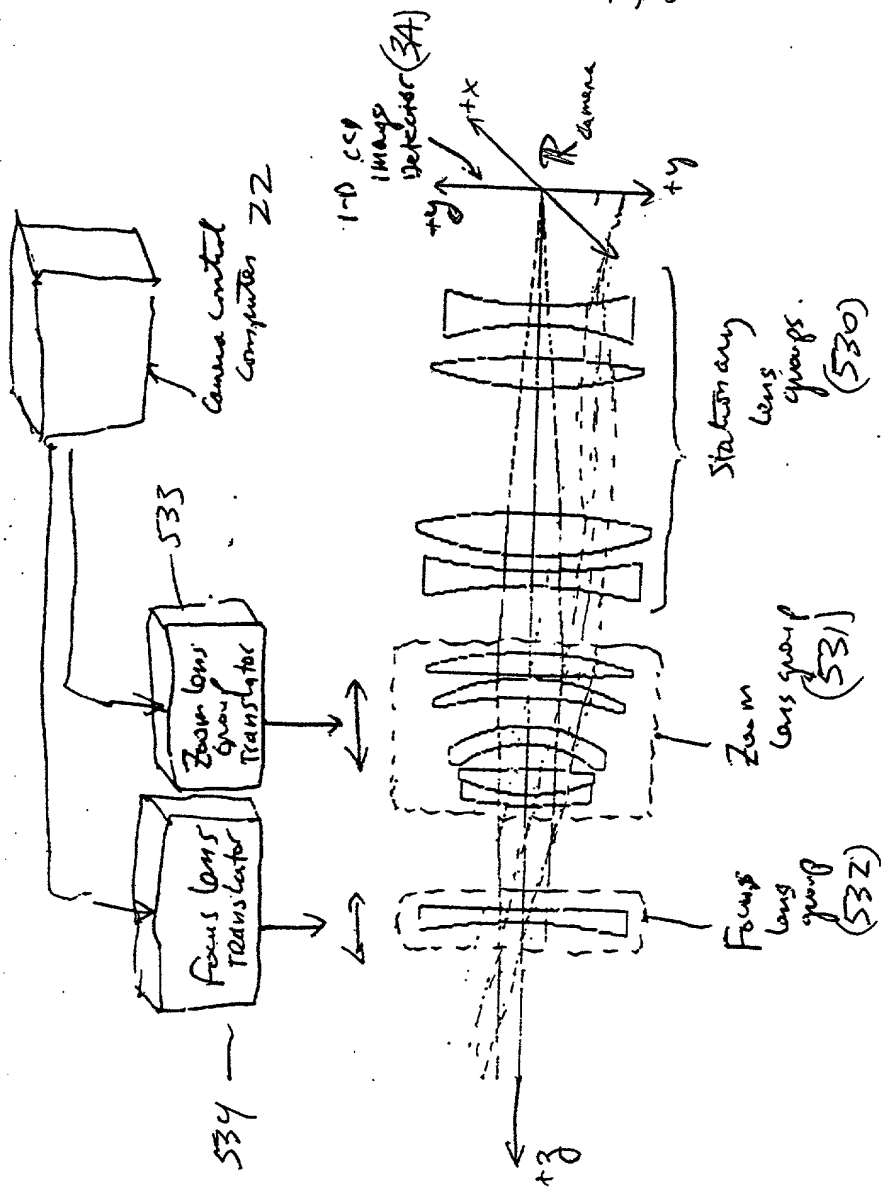


FIG. 12D

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(main optics)
(lens groups)

FIG. 12E

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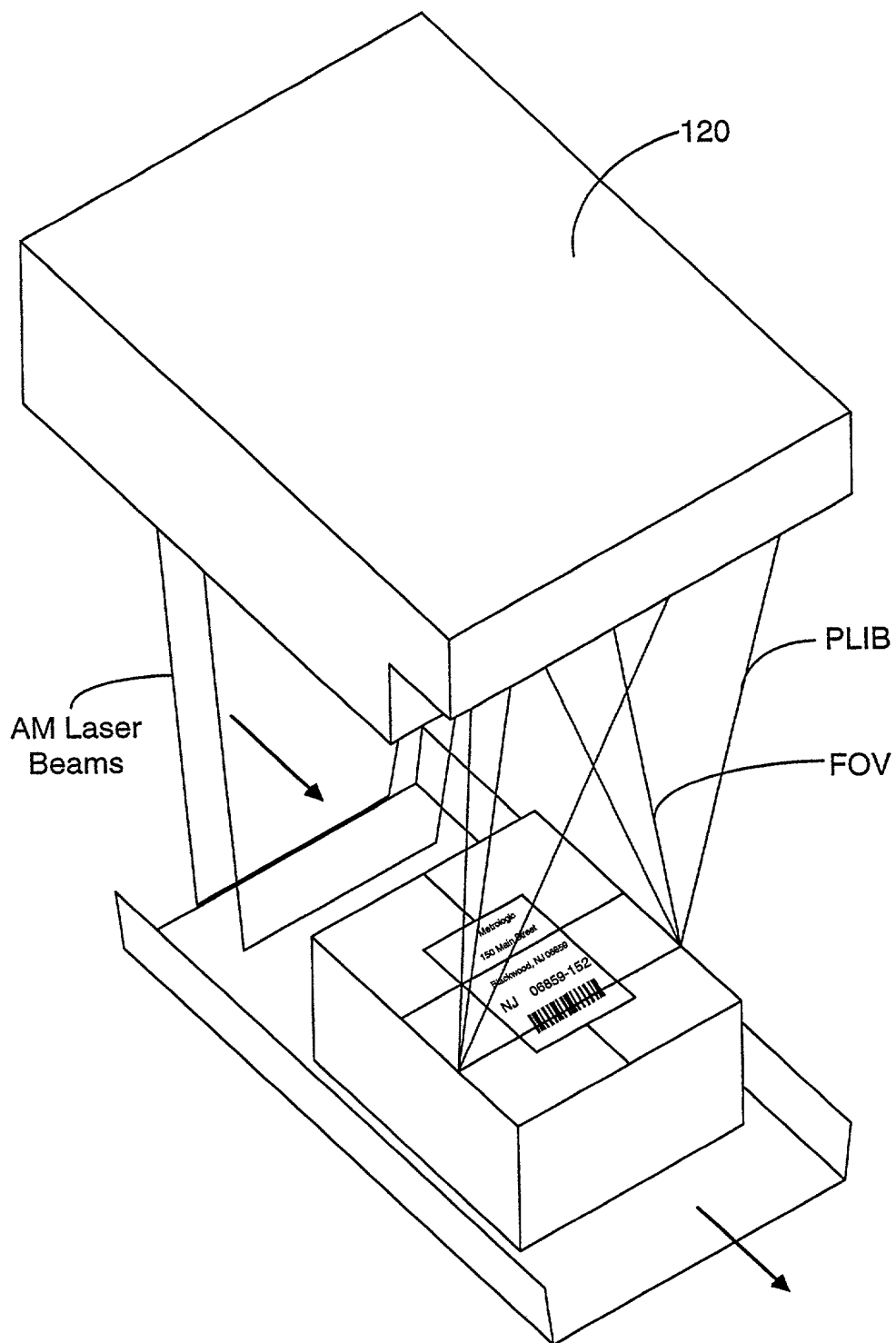


FIG. 13A

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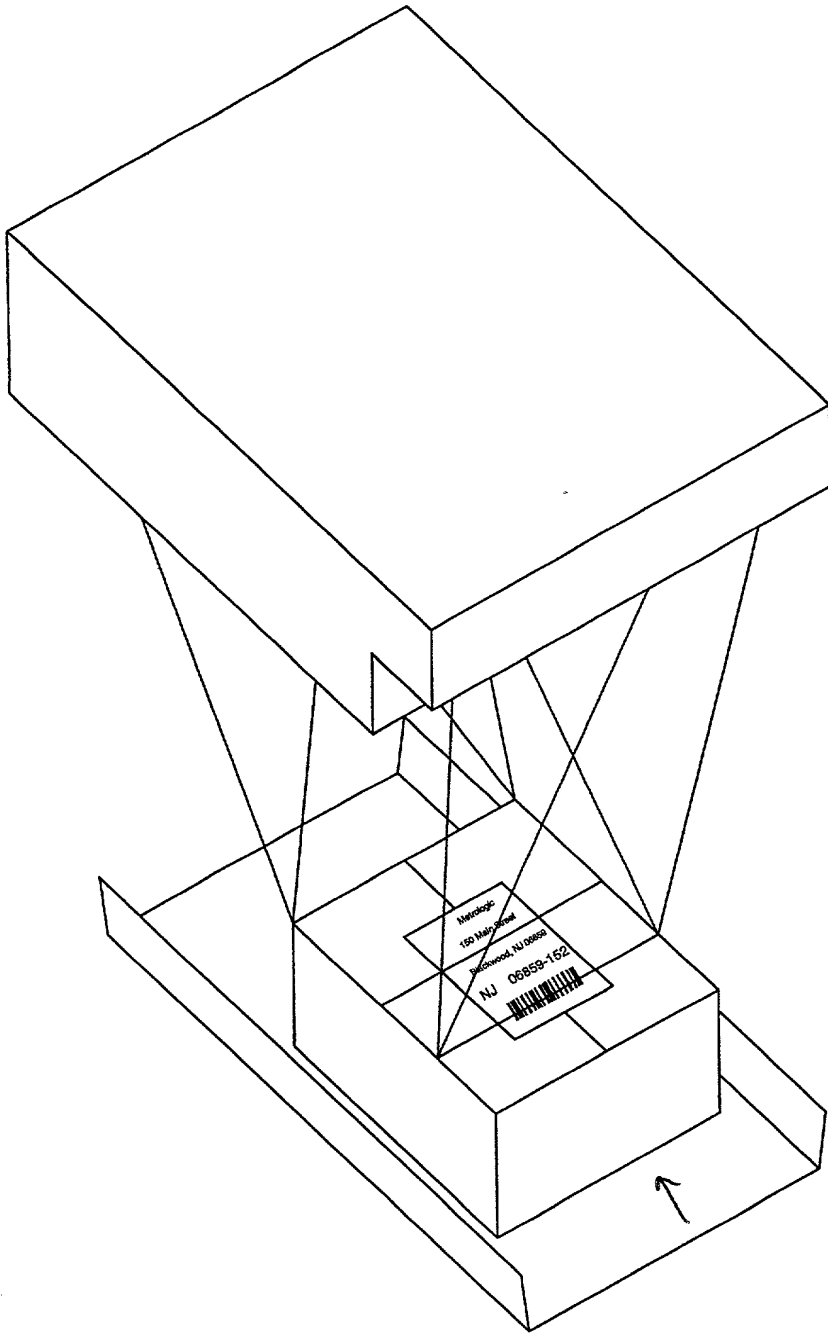


FIG. 13A

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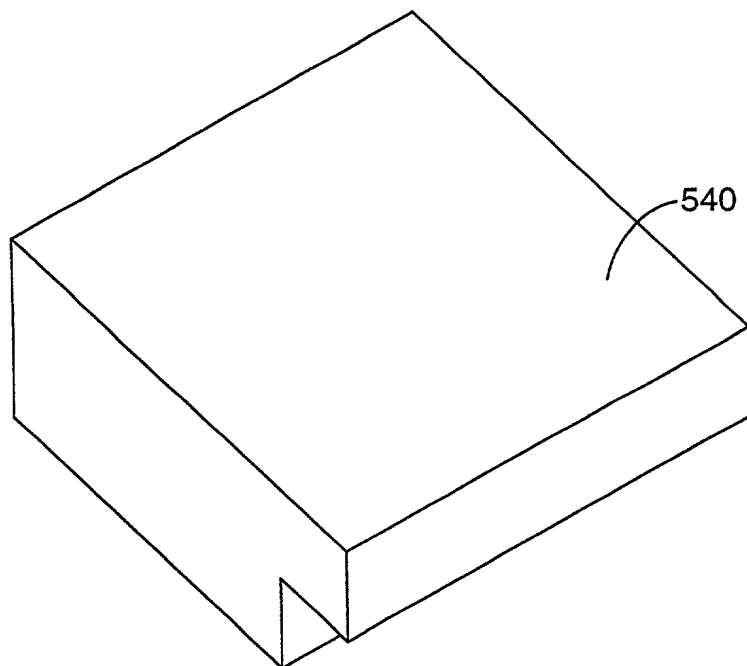


FIG. 13B

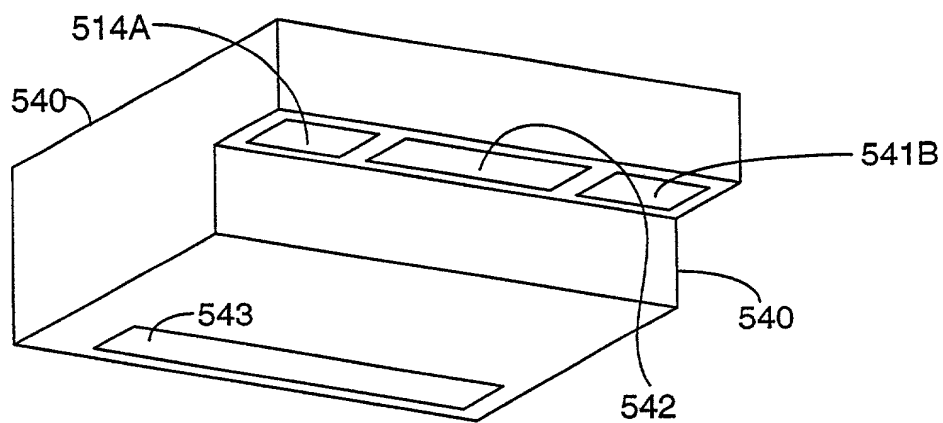


FIG. 13C

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 PLLIM-BASED PACKAGE IDENTIFICATION AND
 DIMENSIONING (PID) SYSTEM

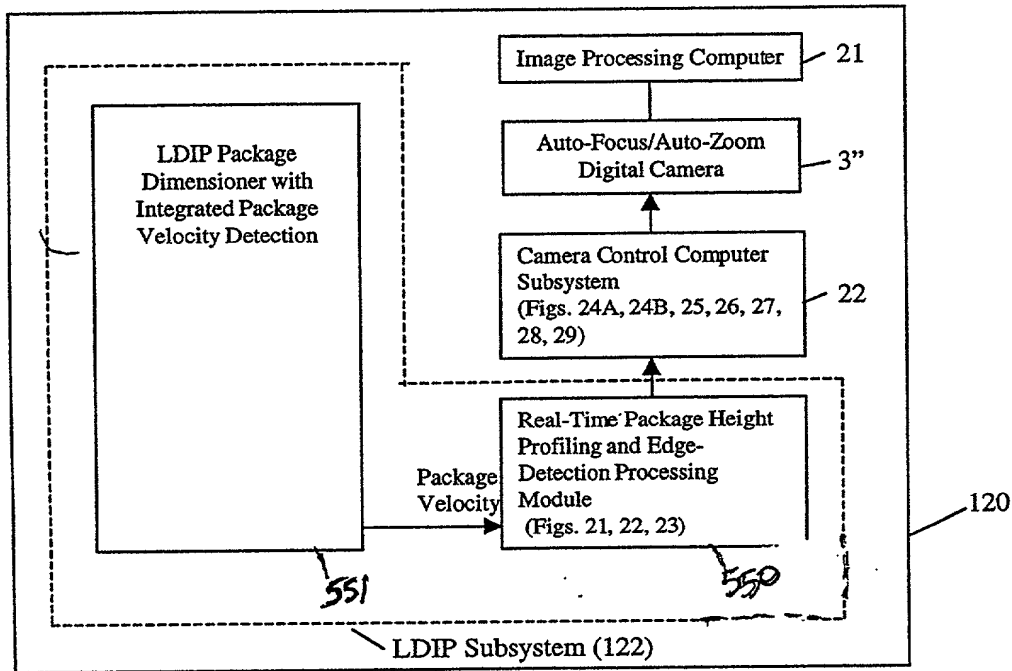


FIG. 14

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LDIP REAL-TIME PACKAGE HEIGHT PROFILE AND EDGE DETECTION METHOD

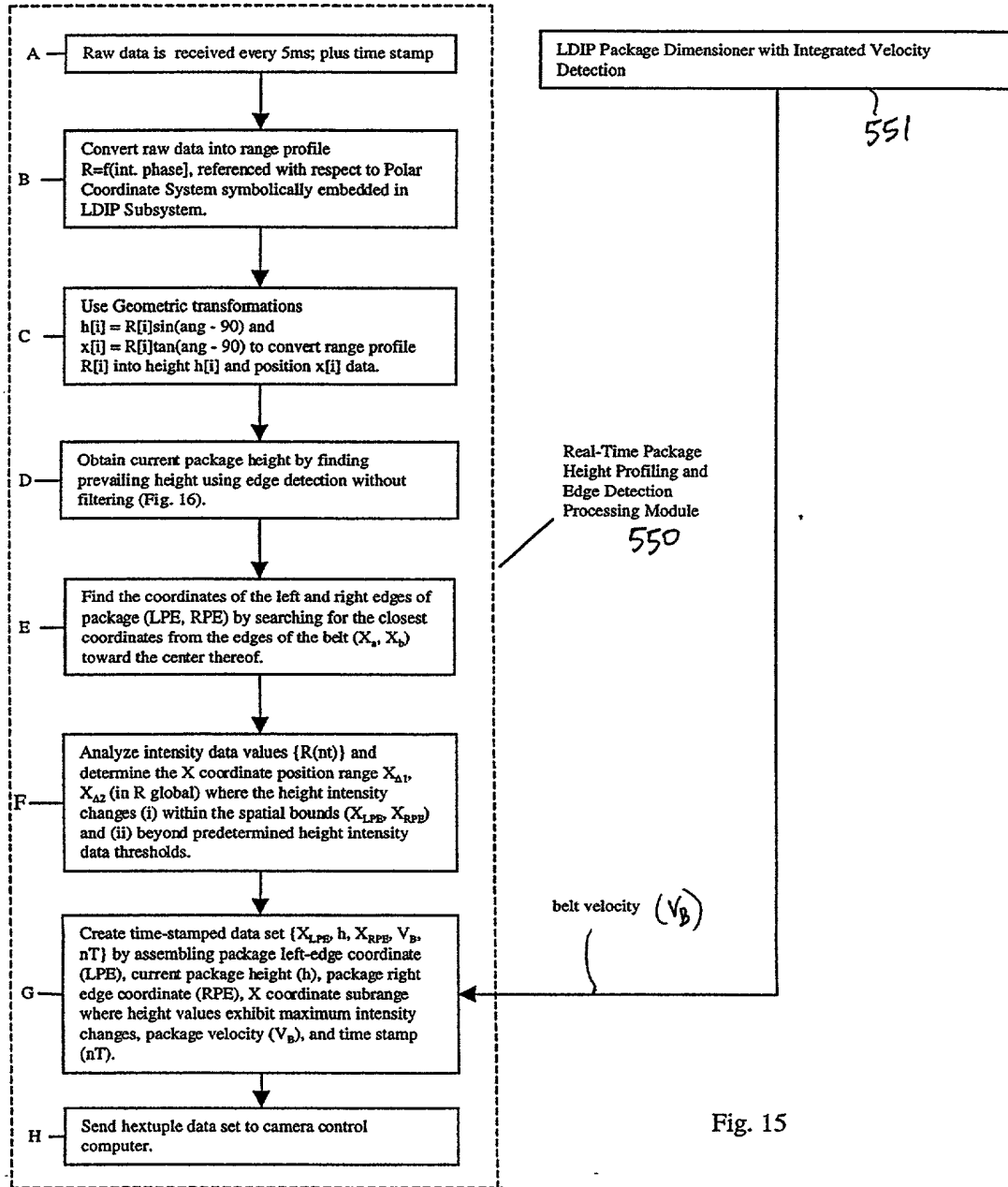


Fig. 15

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LDIP Real Time Package Edge Detection

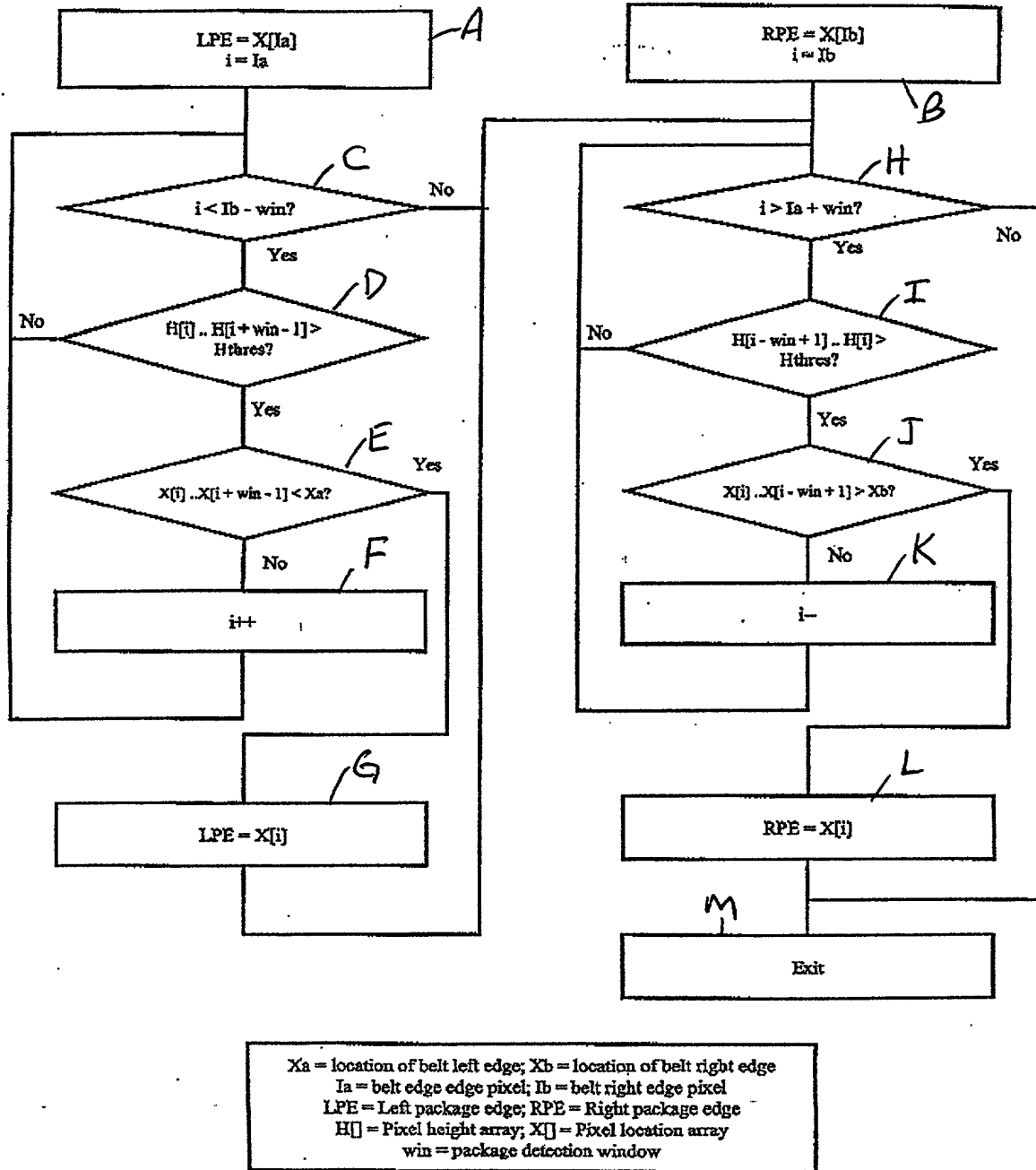


FIG. 16

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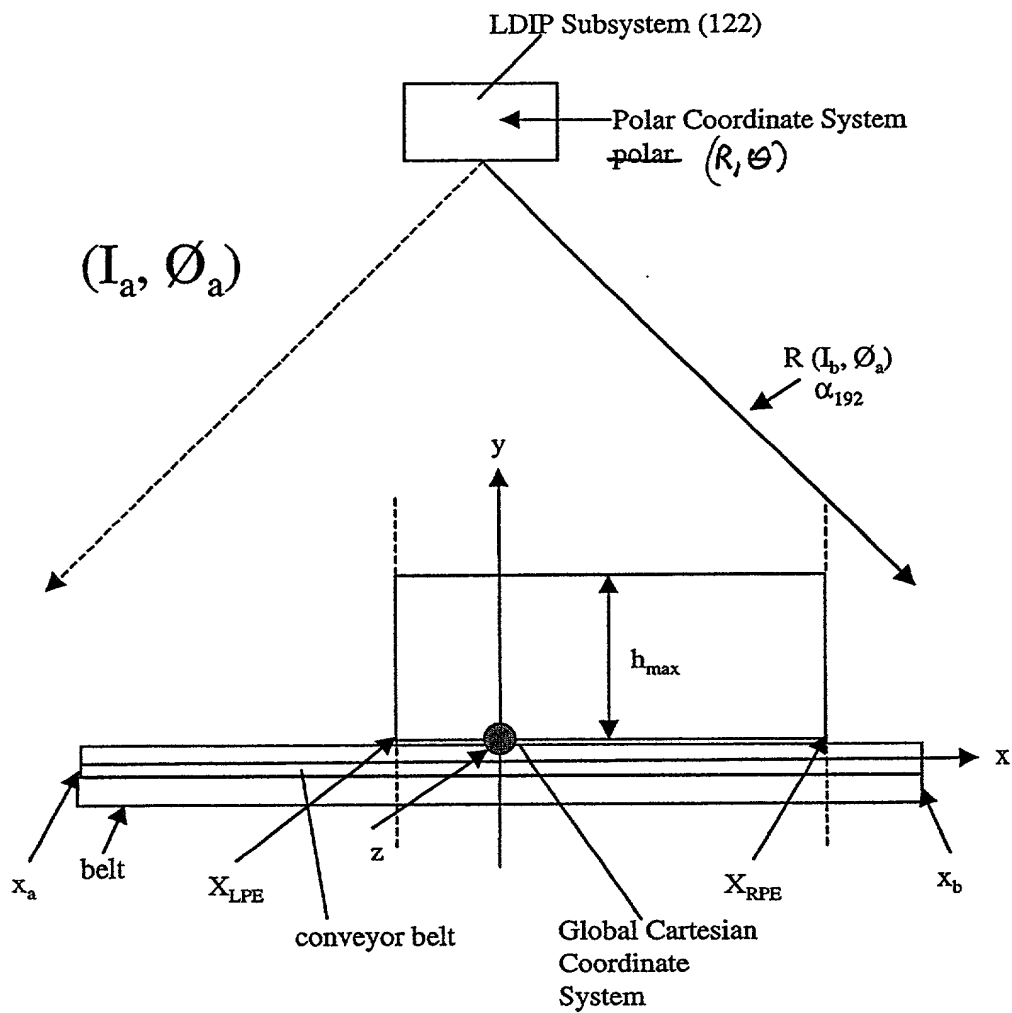


Fig. 17

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 INFORMATION MEASURED AT SCAN ANGLES BEFORE
 COORDINATE TRANSFORMS

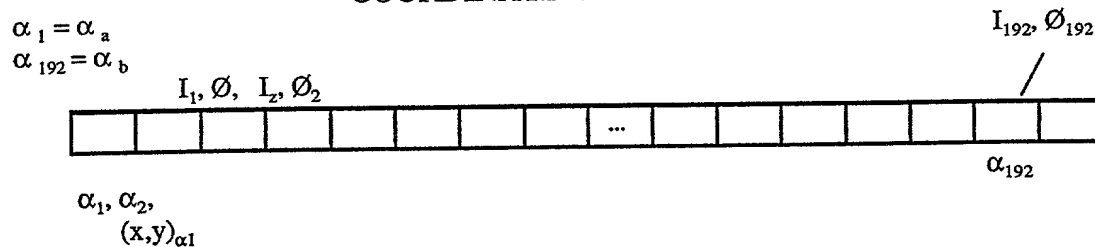


Fig. 17A

RANGE AND POLAR ANGLE MEASURES TAKEN AT SCAN
 ANGLE α BEFORE COORDINATE TRANSFORMS

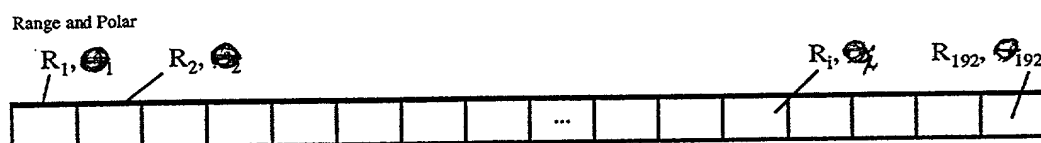


Fig. 17B

MEASURED PACKAGE HEIGHT AND POSITION VALUES
 AFTER COORDINATE TRANSFORMS

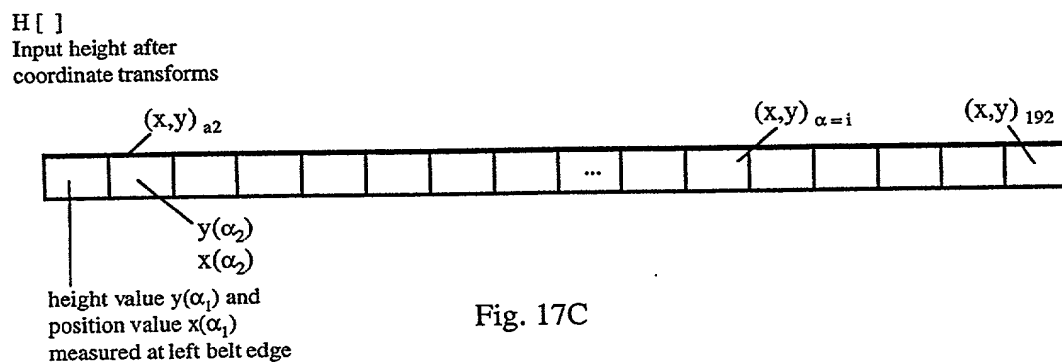


Fig. 17C

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CAMERA CONTROL PROCESS CARRIED OUT WITHIN THE CAMERA CONTROL SUBSYSTEM OF EACH OBJECT IDENTIFICATION AND ATTRIBUTE ACQUISITION SYSTEM OF PRESENT INVENTION

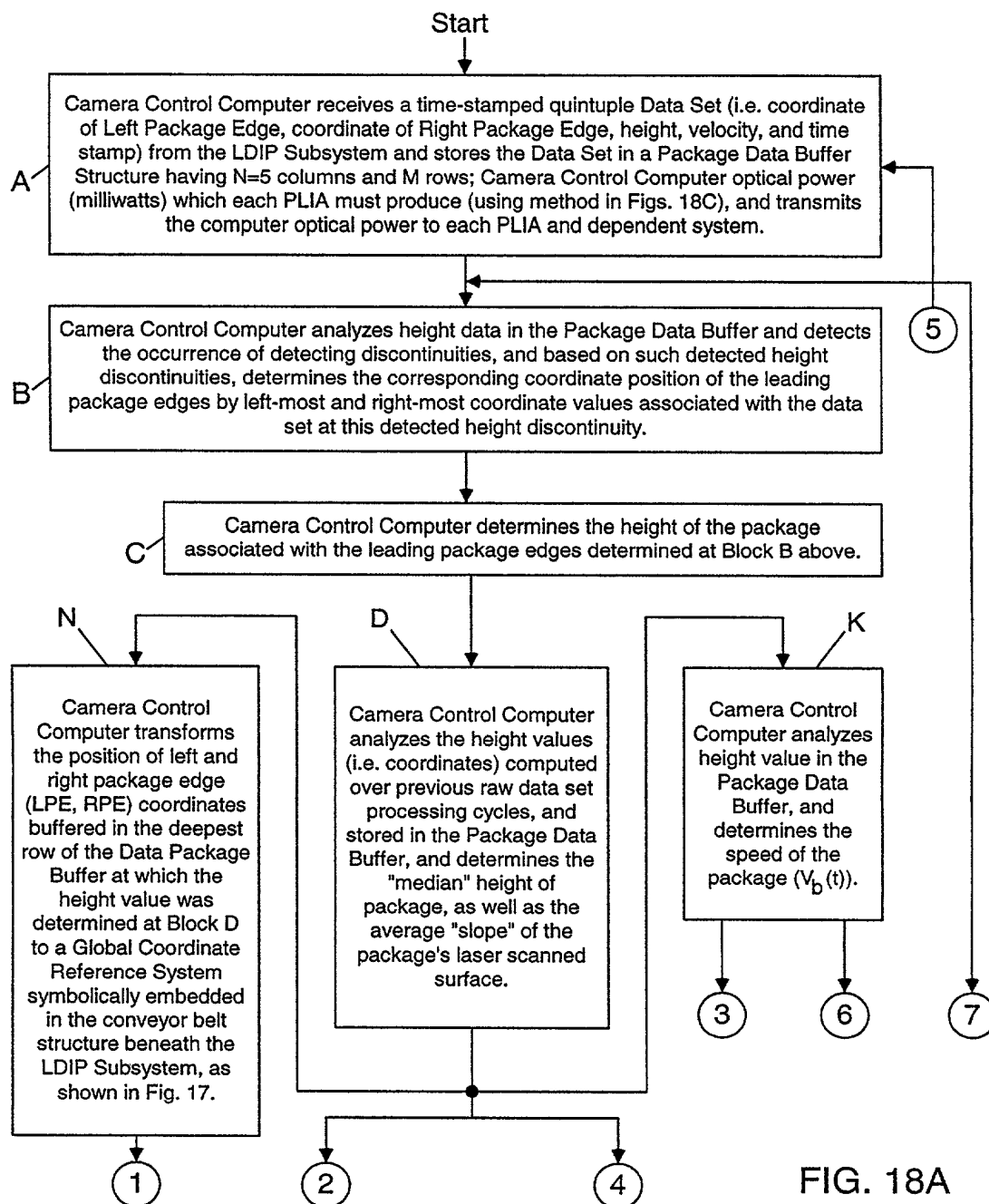


FIG. 18A

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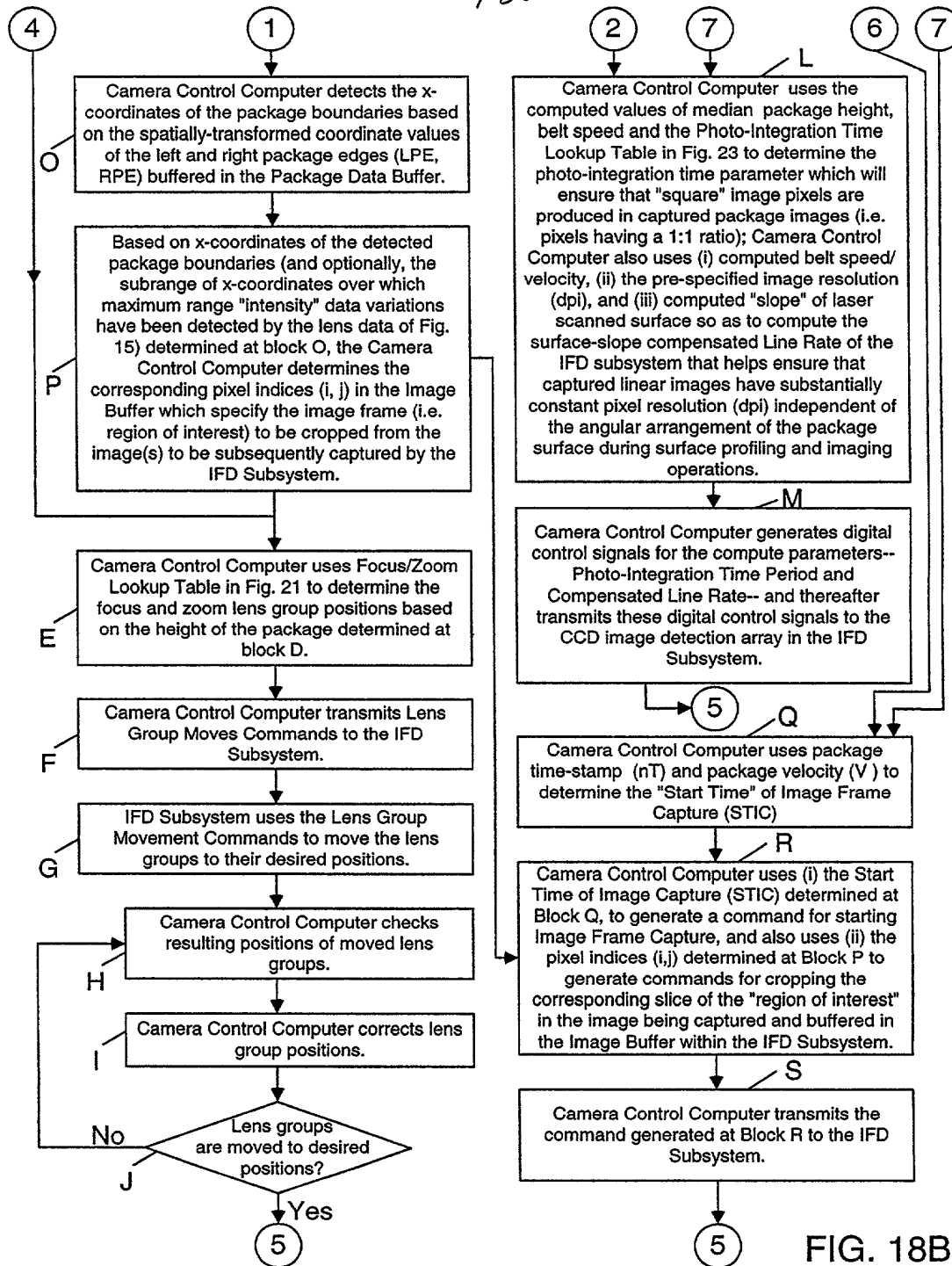


FIG. 18B

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METHOD OF COMPUTING OPTICAL OUTPUT POWER FROM CASE
DIODES IN PLANAR LASER ILLUMINATION ARRAY (PLIA) FOR
CONTROLLING CONSTANT WHITE LEVEL IN IMAGE PIXELS CAPTURED
BY PLIIM-BASED LINEAR IMAGER

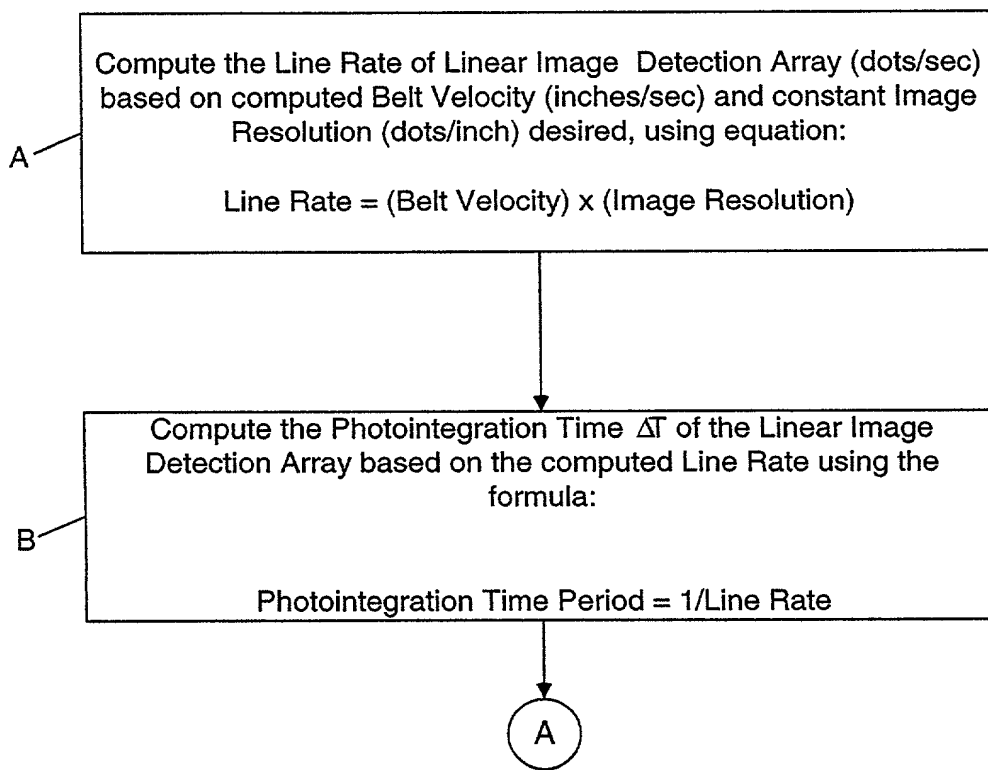


FIG. 18C1

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A



Compute the Optical Power (milliwatts) of each PLIA based on computed Photointegration Time Period (ΔT) using the following formula:

$$\text{Optical Power of VLD (milliwatts)} = \frac{\text{constant}}{\text{Photointegration Time Period } \Delta T}$$

FIG. 18C2

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METHOD OF COMPUTING COMPENSATED LINE RATE FOR CORRECTING
VIEWING-ANGLE DISTORTION OCCURING IN IMAGES OF OBJECT
SURFACES CAPTURED AS OBJECT SURFACES MOVE PAST PLIM-
BASED LINEAR IMAGER AT NON-ZERO SKEWED ANGLE

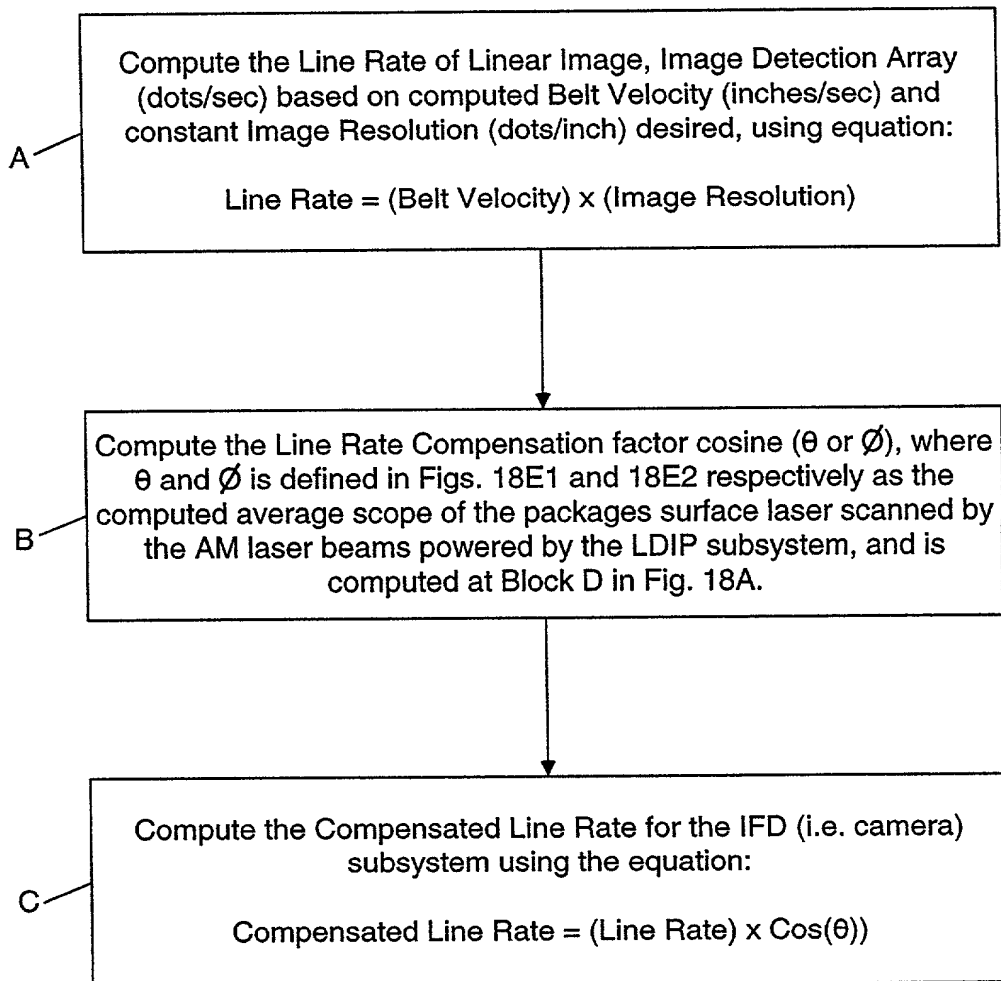


FIG. 18D

CASE 1:
Top Down Imaging

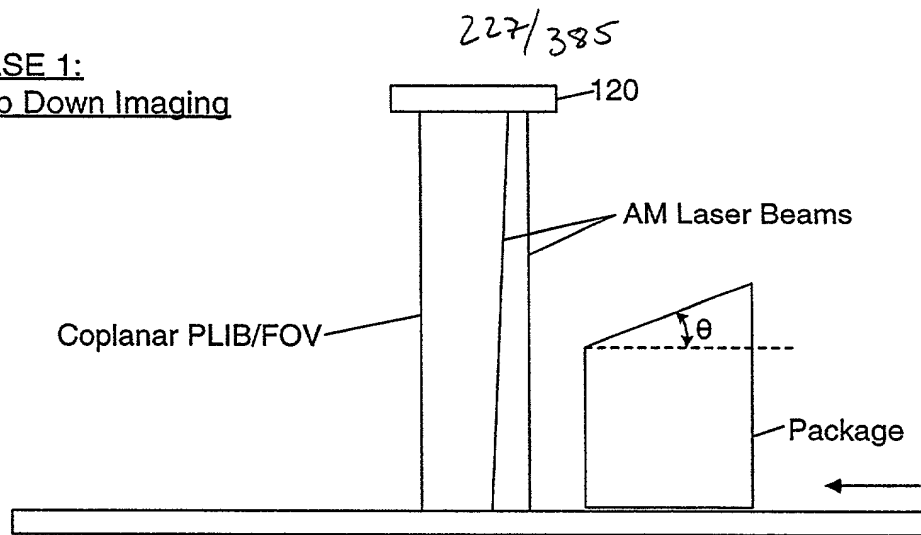


FIG. 18E1

CASE 2:
Side Imaging

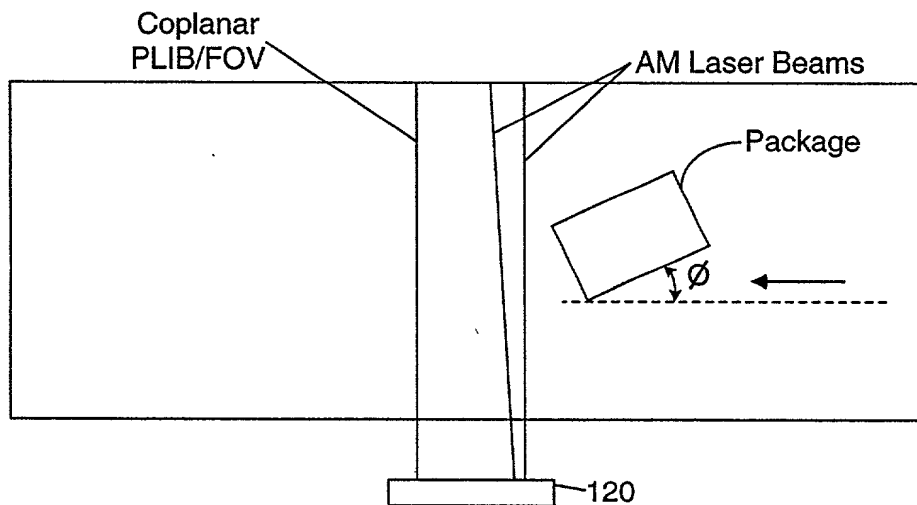


FIG. 18E2

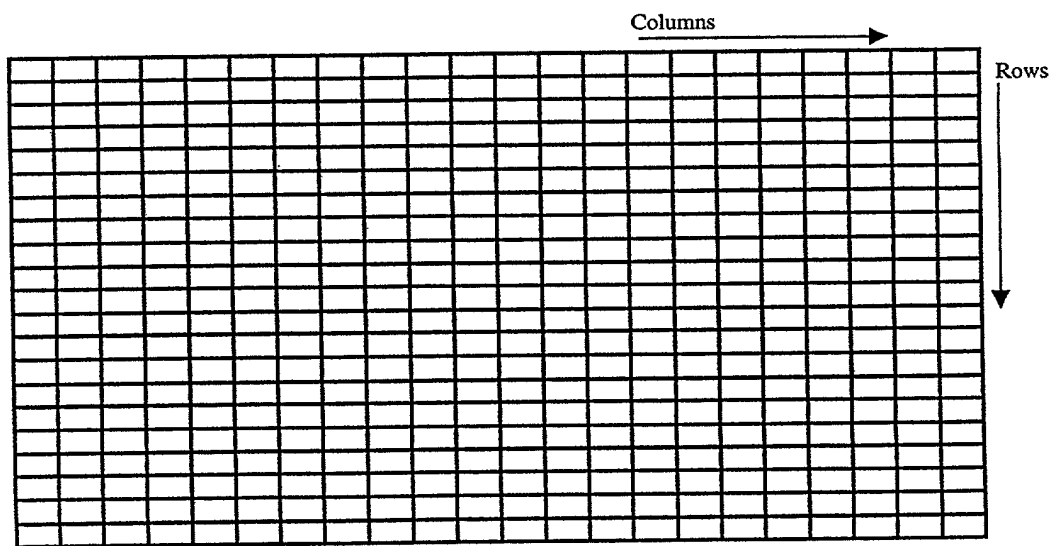
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X coordinate subrange where
maximum range "intensity"
variations have been detected

Left Package Edge (LDE)	Package Height (h)	Right Package Edge (RPE)	Package Velocity	Time-stamp (nT)	
					Row 1
					Row 2
					Row 3
					Row 4
					Row 5
					Row M

Package Data Buffer (FIFO)

Fig. 19



Camera Pixel Data Buffer
pixel indices (i,j)

Fig. 20

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Zoom and Focus Lens Group position
Look-up Table

Distance from Camera H (mm)	Zoom group distance (mm) Y (Zoom)	Focus group distance (mm) Y (Focus)
1000	21.57489228	2.47E-05
1100	19.38089696	10.99009783
1200	17.10673434	20.65783177
1300	14.77137314	29.10917002
1400	12.39153565	36.47312595
1500	9.979114358	42.87845436
1600	7.540639114	48.44003358
1700	5.078794775	53.25495831
1800	2.595989366	57.40834303
1900	0.099972739	60.98883615

(use
interpolation
techniques
for working
distances
between listed
points in
table)

FIG. 21.

* Note: On focal distance & zoom (left-hand graph) in camera lens are coupled (inter-dependent) in camera has a fixed aperture F5.6

Focus and Zoom lens movement vs. working distances

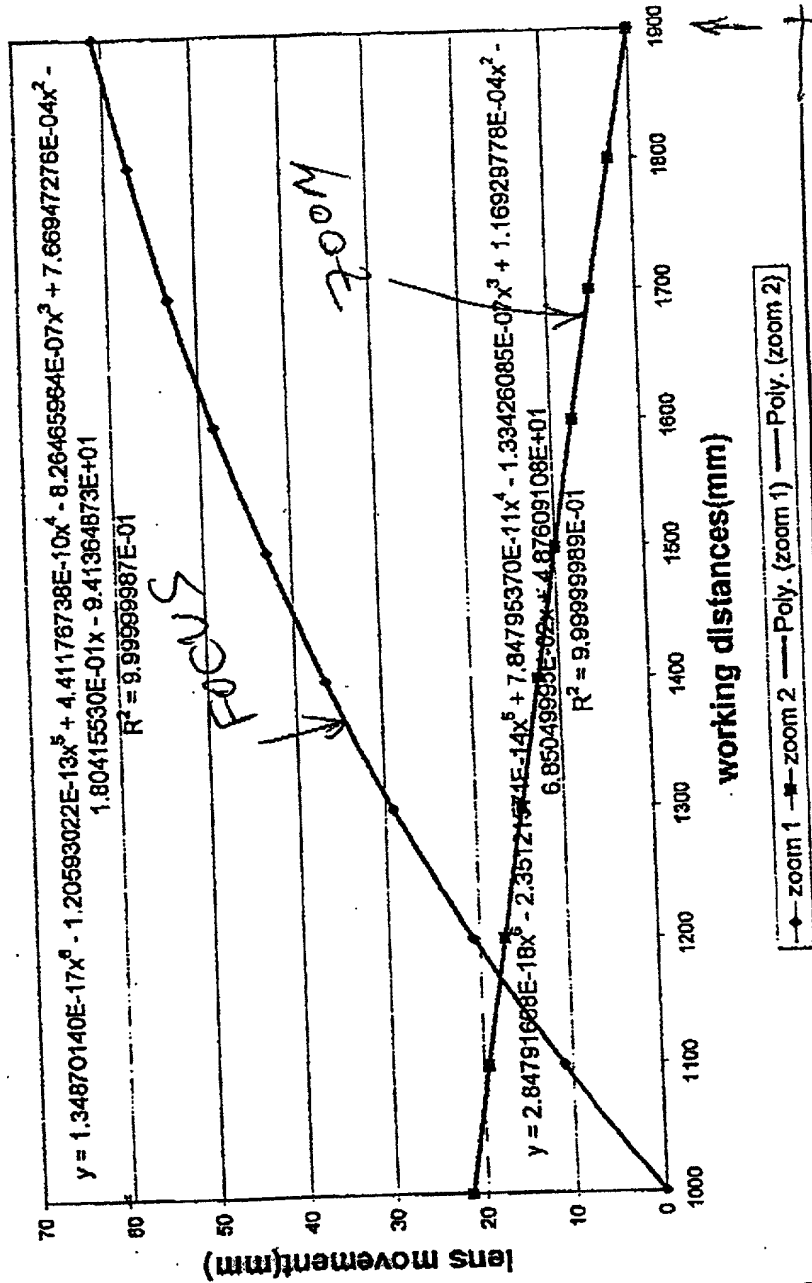


FIG. 22A

Photo-Integration Time Look-Up Table

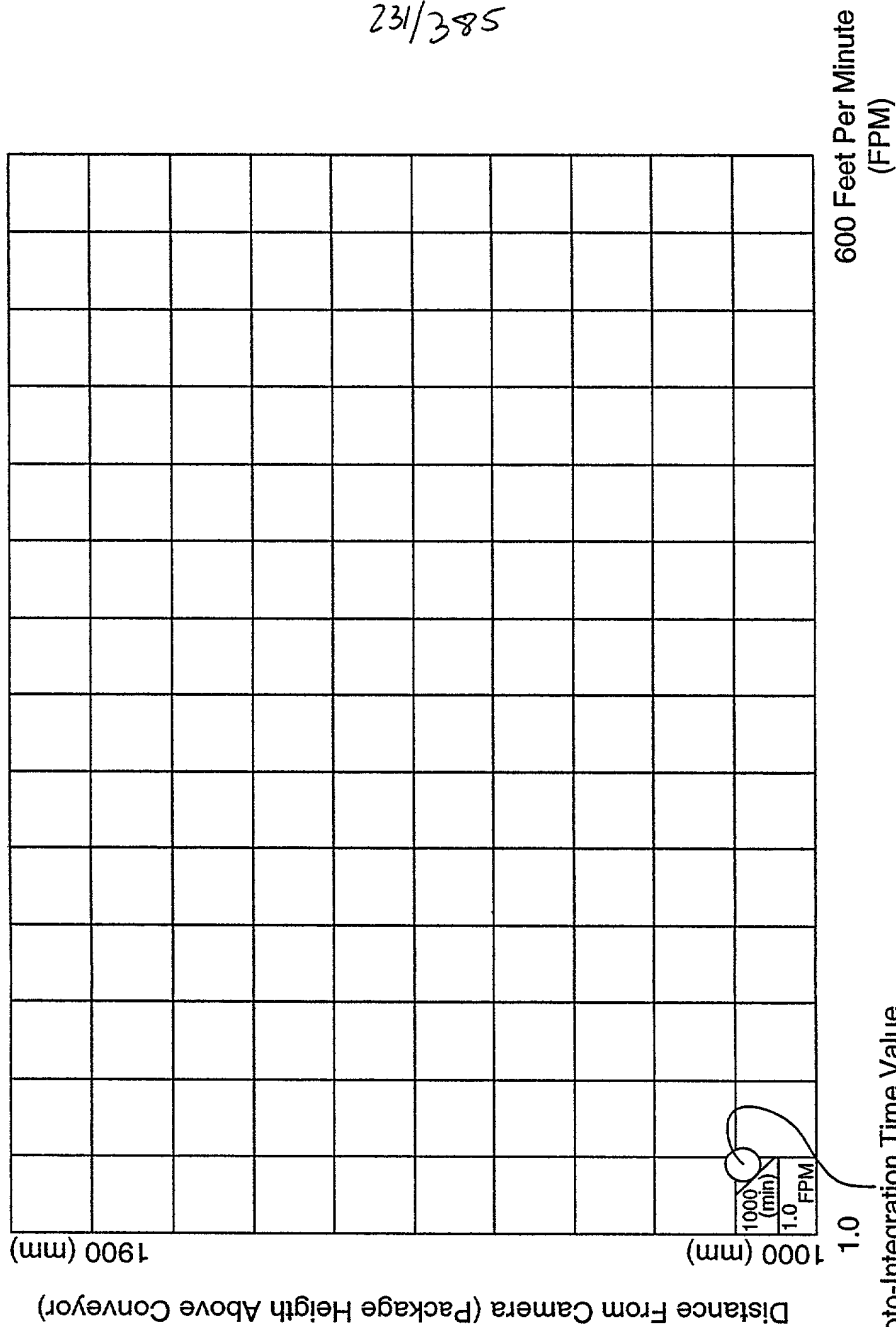


Photo-Integration Time Value
That Ensures Square Image
Pixels (1:1 aspect ratio)

FIG. 22B

Geometrical Modelling Of Arbitrary 3-D Object Surface At Image Processing Computer

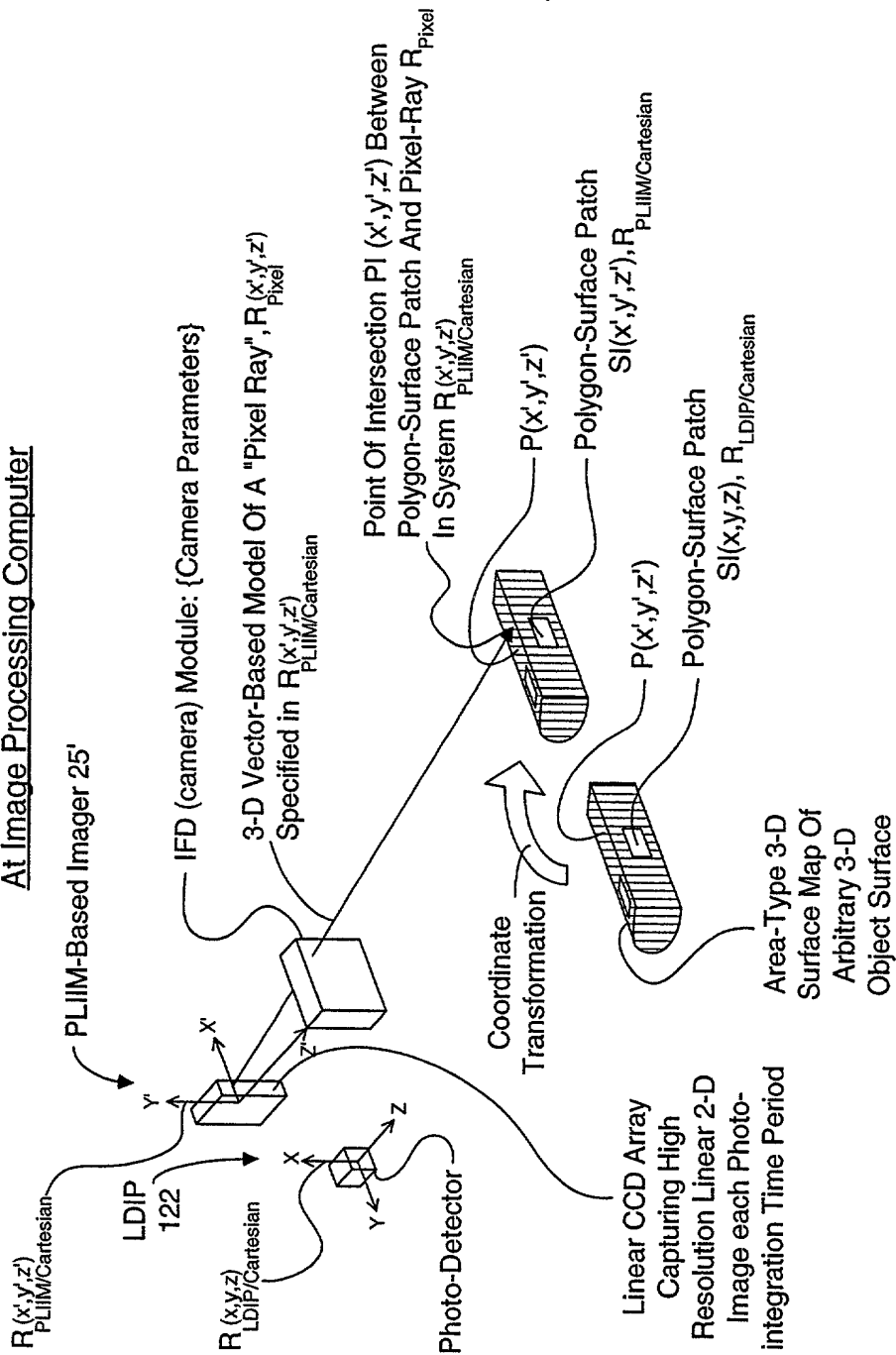


FIG. 23B

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METHOD OF AND APPARATUS FOR PERFORMING AUTOMATIC
RECOGNITION OF GRAPHICAL INTELLIGENCE CONTAINED IN 2-D
IMAGES CAPTURED FROM ARBITRARY 3-D OBJECT SURFACES

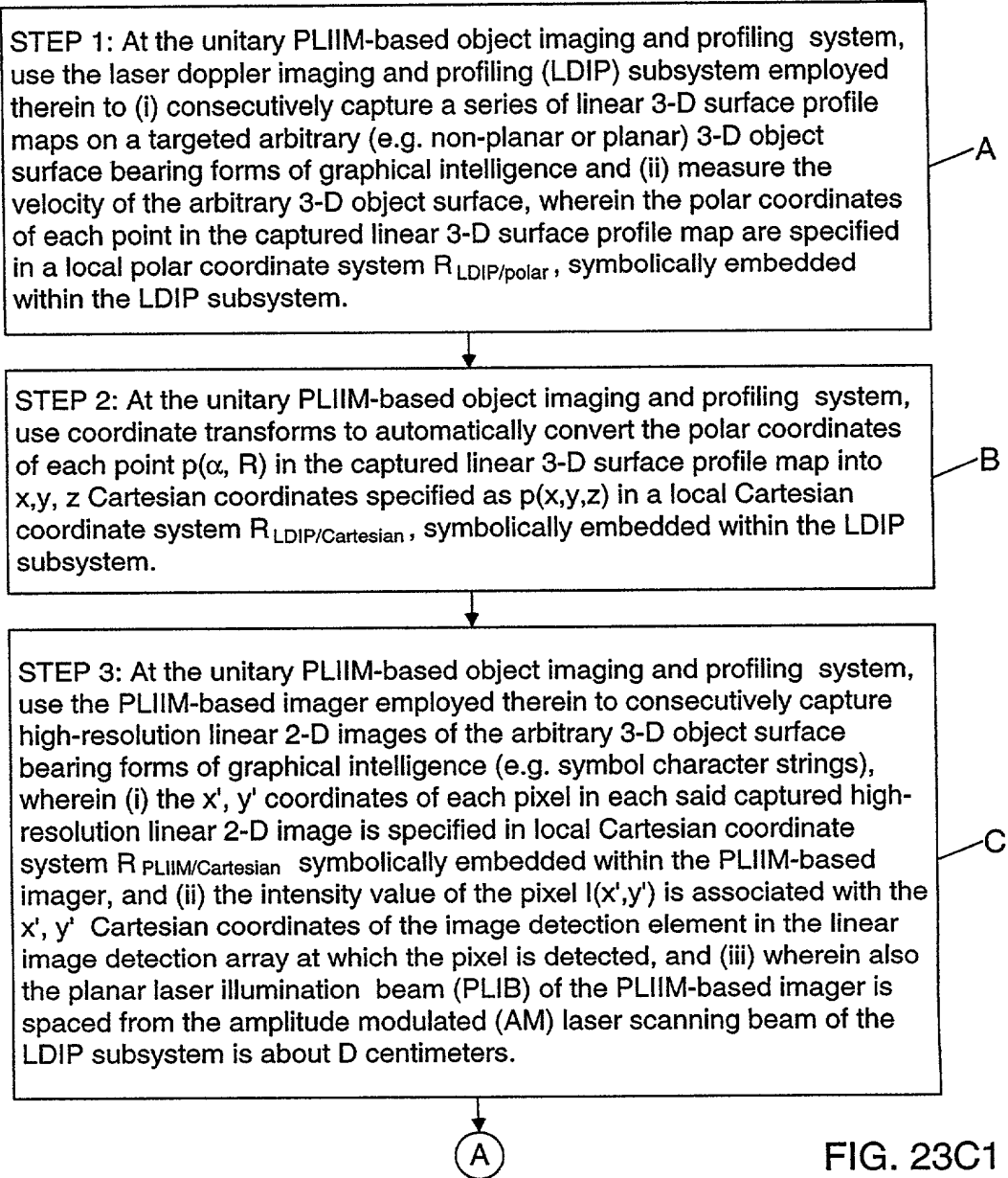


FIG. 23C1

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A

STEP 4: At the unitary PLIIM-based object imaging and profiling system, capture and buffer the camera (IFD) parameters used to form and detect each linear high-resolution 2-D image captured during the corresponding photo-integration time period ΔT_K , by the PLIIM-based imager.

D

STEP 5: At the end of each photo-integration time period ΔT_K , use the unitary PLIIM-based object imaging and profiling system to transmit the following information elements to the Image Processing Computer for data storage and subsequent information processing:

(1) the converted coordinates x, y, z , of each point in the linear 3-D surface profile map of the arbitrary 3-D object surface captured during photo-integration time period ΔT_K ;

(2) the measured velocity(ies) of the arbitrary 3-D object surface during photo-integration time period ΔT_K ;

(3) the x', y' coordinates and intensity value $I(x', y')$ of each pixel in each high-resolution linear 2-D image captured during photo-integration time period ΔT_K and specified in the local Cartesian coordinate system $R_{PLIIM/Cartesian}$; and

(4) the captured camera (IFD) parameters used to form and detect each linear high-resolution 2-D image captured during the photo-integration time period ΔT_K

E

STEP 6: At the Image Processing Computer, receive the data elements transmitted from the PLIIM-based profiling and imaging system during Step 5, buffer data elements (1) and (2) in a first FIFO buffer memory structure, and data elements (3) and (4) in a second FIFO buffer memory structure.

F

B

FIG. 23C2

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(B)

STEP 7: At the Image Processing Computer, use the x, y, z coordinates associated with a consecutively captured series of linear 3-D surface profile maps (i.e. stored in first FIFO memory storage structure) in order to construct a 3-D polygon-mesh surface representation of said arbitrary 3-D object surface, represented by $S_{LDIP}(x, y, z)$ and having (i) vertices specified by x, y, z in local coordinate reference system $R_{PLIIM/Cartesian}$, and (ii) planar polygon surface patches $s_i(x, y, z)$ and being defined by a set of said vertices.

G

STEP 8: At the Image Processing Computer, convert the x', y', z' coordinates of each vertex in the 3-D polygon-mesh surface representation into the local Cartesian coordinate reference system $R_{PLIIM/Cartesian}$ symbolically embedded within the PLIIM-based imager.

H

STEP 9: At the Image Processing Computer, specify the x', y', z' coordinates of each i -th planar polygon surface patch $s(x, y, z)$ represented in the local Cartesian coordinate reference system $R_{PLIIM/Cartesian}$, so as to produce a set of corresponding polygon surface patch $\{s_i(x', y', z')\}$ represented in system $R_{PLIIM/Cartesian}$

I

STEP 10: At the Image Processing Computer, for a selected linear high-resolution 2-D image captured at photo-integration time period ΔT_K , and spatially corresponding to one of the linear 3-D surface profile maps employed at Step 7, use the camera (IFD) parameters used and recorded (i.e. captured) during the corresponding photo-integration time period in order to construct a 3-D vector-based "pixel ray" model specifying the optical formation of each pixel in the linear 2-D image, wherein a pixel ray reflected off a point on the arbitrary 3-D object surface is focused through the camera's image formation optics (i.e. configured by the camera parameters) and is detected at the pixel's detection element in the linear image detection array of the IFD (camera) subsystem.

J

(C)

FIG. 23C3

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C

STEP 11: At the Image Processing Computer, for each laser beam ray (producing one of the pixels in said selected linear 2-D image), (i) determine which polygon surface patch $s_i(x, y, z)$ the pixel ray intersects, (ii) compute the x, y, z coordinates of the point of intersection (POI) between the pixel ray and the polygon surface patch represented in Cartesian coordinate reference system $R_{PLIIM/Cartesian}$, and (iii) designate the computed set of points of intersection as $\{p_i(x, y, z)\}$.

K

STEP 12: At the Image Processing Computer, for each laser beam ray passing through a determined polygon surface patch $s(x', y', z')$ at a computed point of intersection $p_i(x, y, z)$, assign the intensity value $I(x', y')$ of the pixel ray to the x', y', z' coordinates of the point of intersection, thereby producing a linear high-resolution 3-D image comprising a 2-D array of pixels, each said pixel pixel having as its attributes (i) an Intensity value $I(x', y', z')$ and (ii) coordinates x', y', z' specified in the local Cartesian coordinate reference system $R_{PLIIM/Cartesian}$.

L

STEP 13: Put the computed linear high-resolution 3-D image in a third FIFO memory storage structure in the image processing computer.

M

STEP 14: Repeat Steps 1-6 to update the first and second FIFO data queues maintained in the image processing computer, and Steps 7-13 to update the consecutively computed linear high-resolution 3-D image stored in the third FIFO memory storage structure.

N

STEP 15: Assemble in an image buffer in the image processing computer, a set of consecutively computed linear high-resolution 3-D images retrieved from the third FIFO data storage device so as to construct an "area-type" high-resolution 3-D image of said arbitrary 3-D object surface.

O

D

FIG. 23C4

(D)

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STEP 16: At the Image Processing Computer, map the intensity value $I(x', y', z')$ of each pixel in the computed area-type 3-D image onto the x', y', z' coordinates of the points on a uniformly-spaced apart "grid" positioned perpendicular to the optical axis of the camera subsystem (i.e. to model the 2-D planar substrate on which the forms of graphical intelligence was originally rendered), wherein said mapping process involves using an intensity weighing function based on the x', y', z' coordinate values of each pixel in the area-type high-resolution 3-D image, thereby producing an area-type high-resolution 2-D image of the 2-D planar substrate surface bearing said forms of graphical intelligence (e.g. symbol character strings).

P

STEP 17: At the Image Processing Computer, use said OCR algorithm to perform automated recognition of graphical intelligence contained in said area-type high-resolution 2-D image of said 2-D planar substrate surface so as to recognize said graphical intelligence and generate symbolic knowledge structures representative thereof.

Q

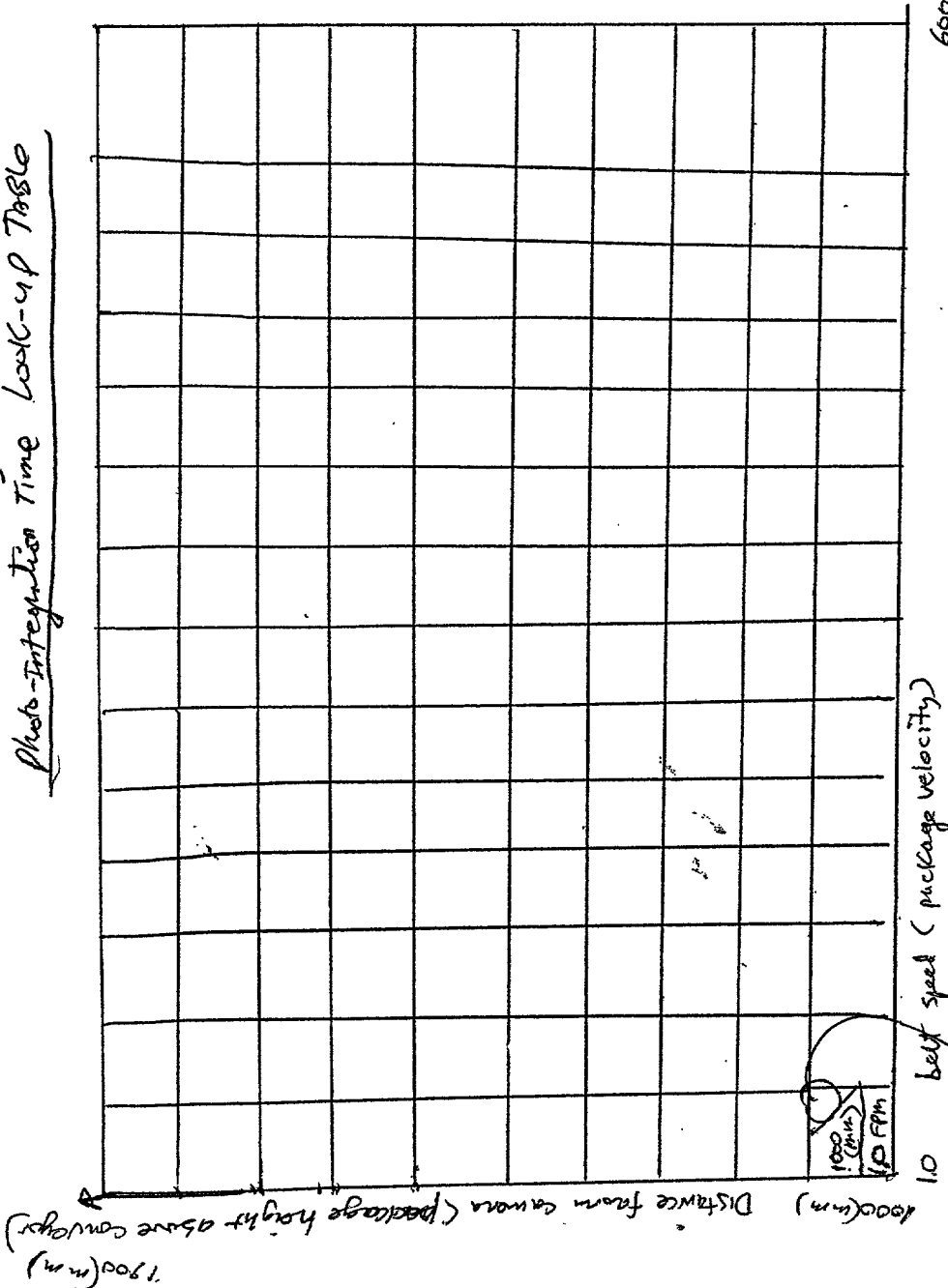
STEP 18: Repeat Steps 1-17 as often as required to recognize changes in graphical intelligence on the arbitrary moving 3-D object surface.

R

FIG. 23C5

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Photo-Integration Time Look-up Table



600 feet per minute
(FPM)

FIG. 22B

Photo-integration
time value that
ensures square image pixels
(1:1 aspect ratio)

LOW RESOLUTION 2D CCD CAMERA (61)
HIGH RESOLUTION 2D CCD CAMERA (55")

LDIP (122)

25"

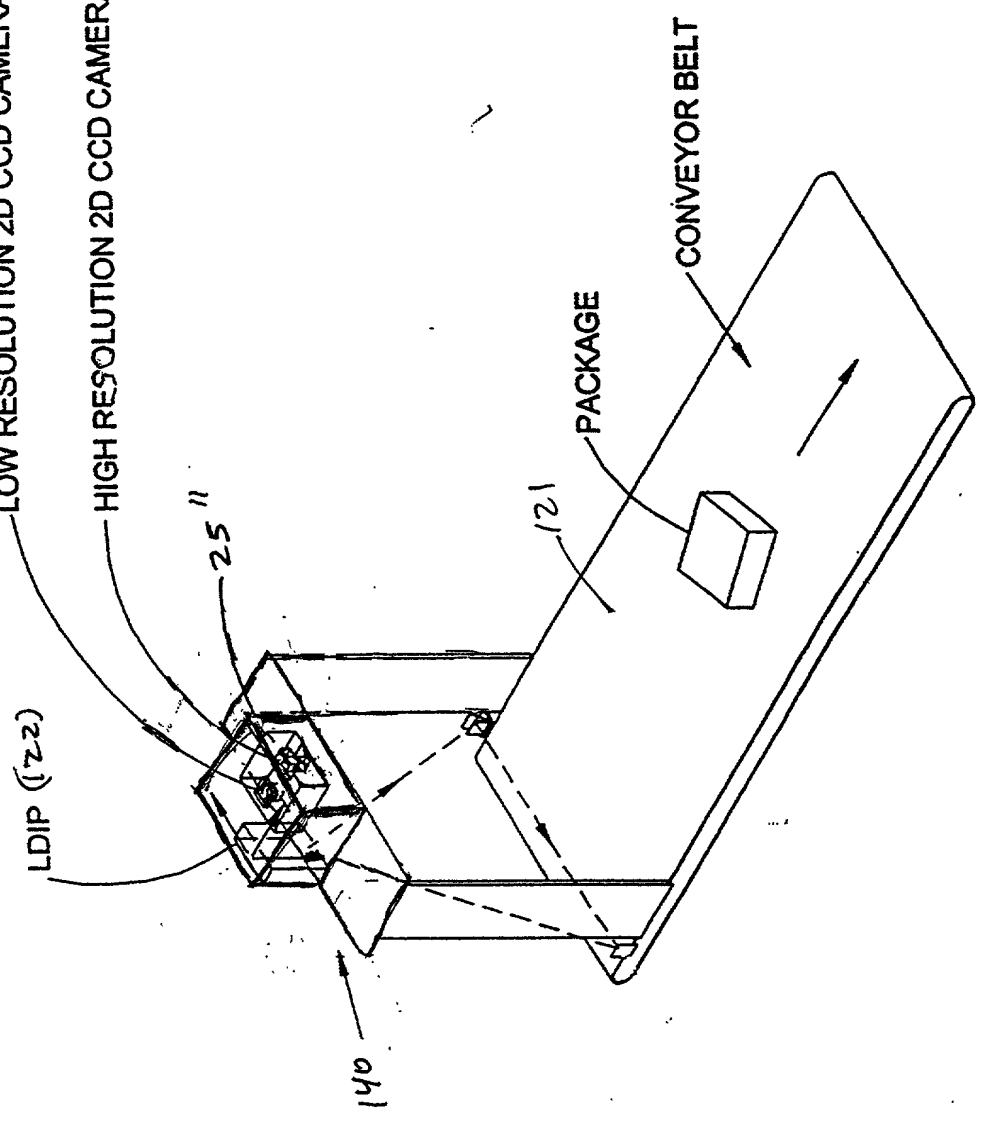
140

PACKAGE

CONVEYOR BELT

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FIG 24



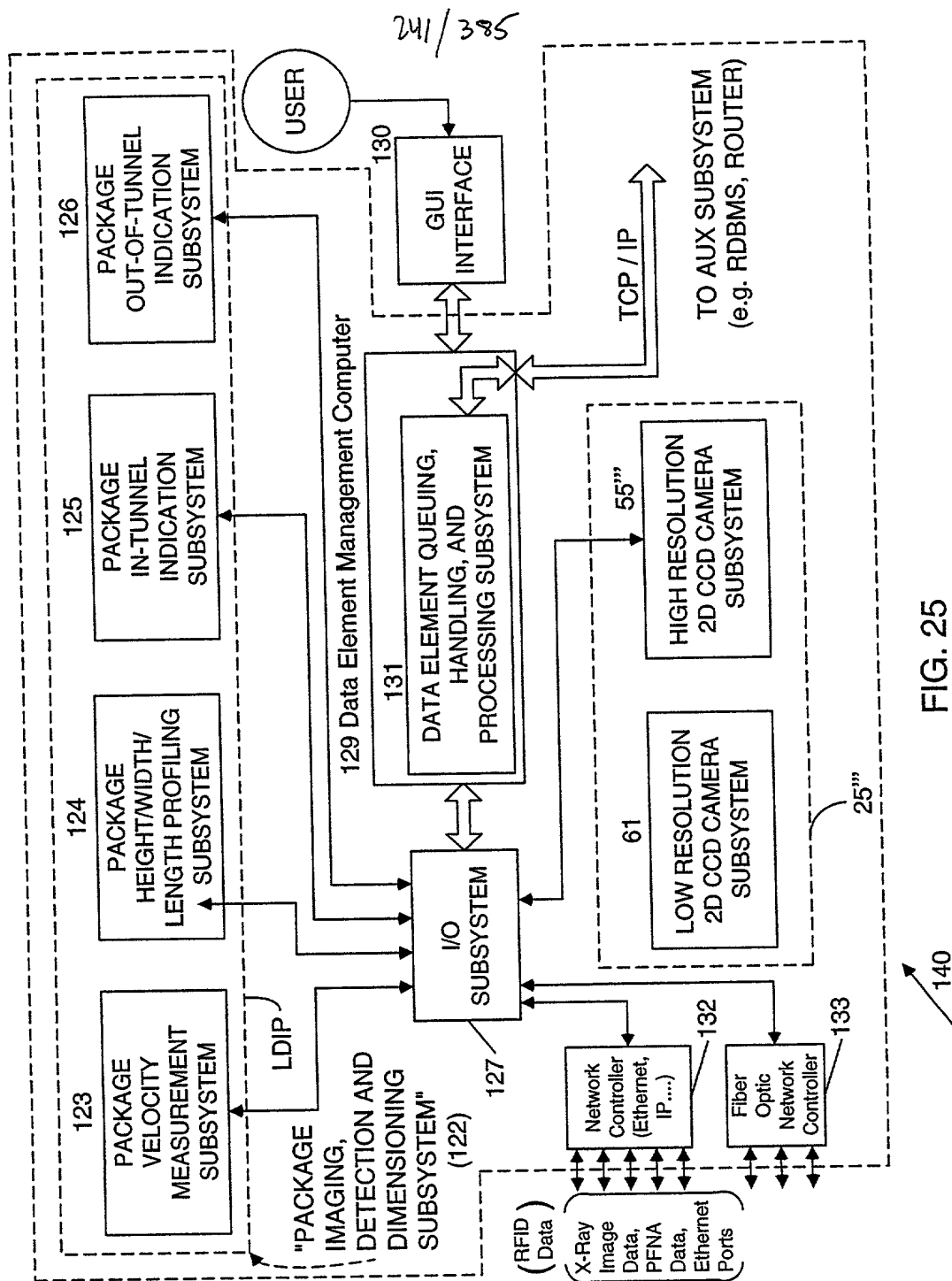


FIG. 25

Patent 5,333,553

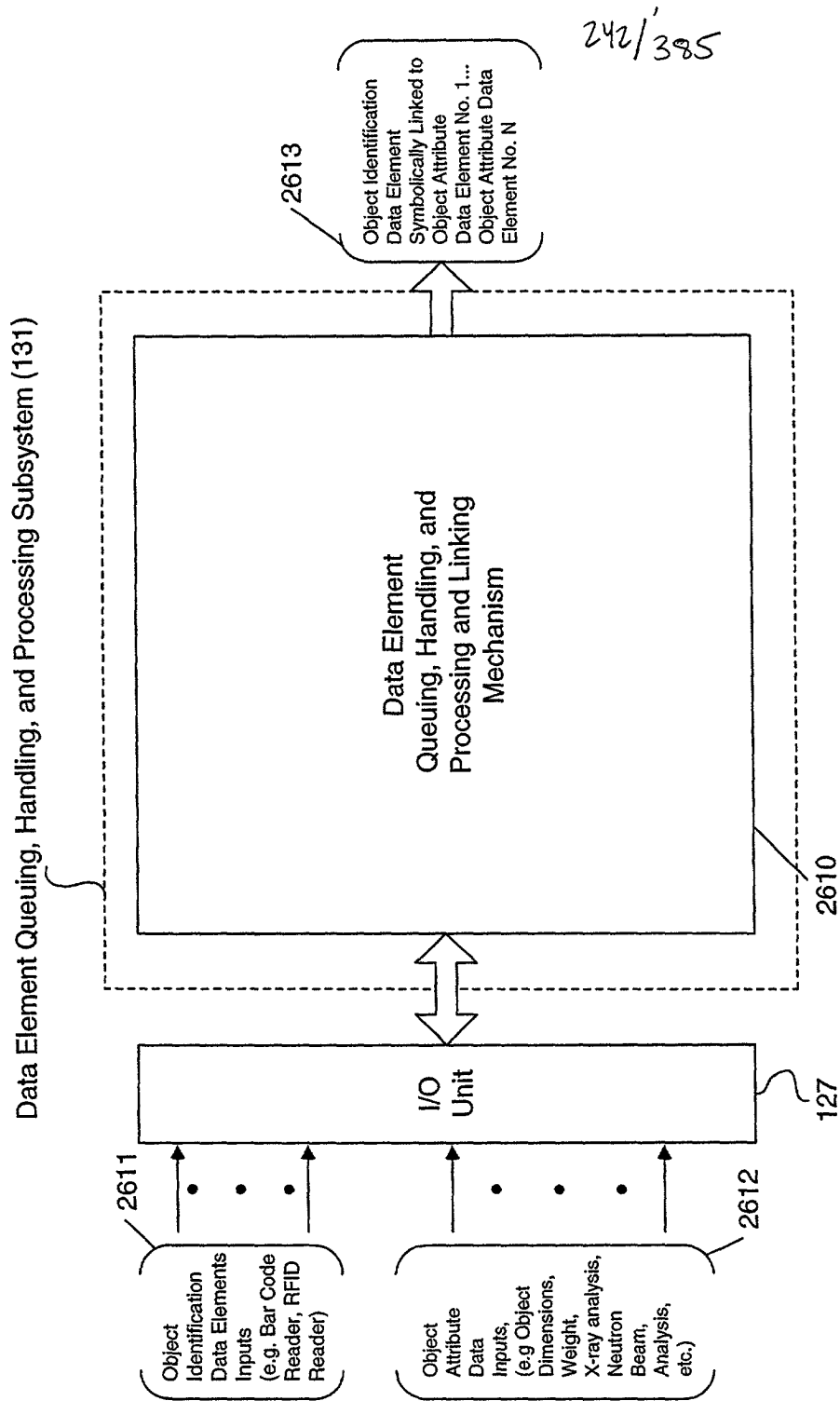


FIG. 25A

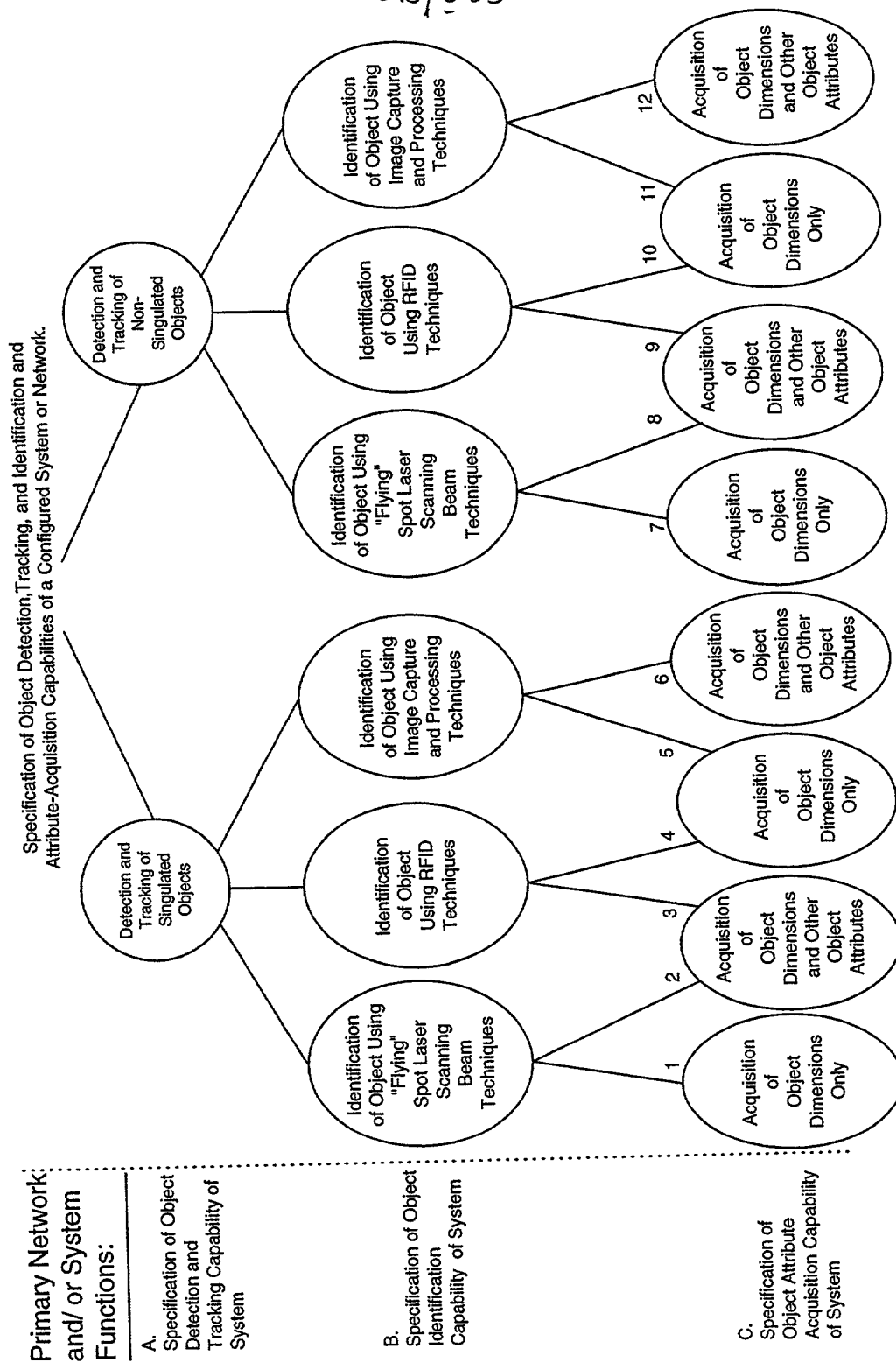
$$243/385$$


FIG. 25B

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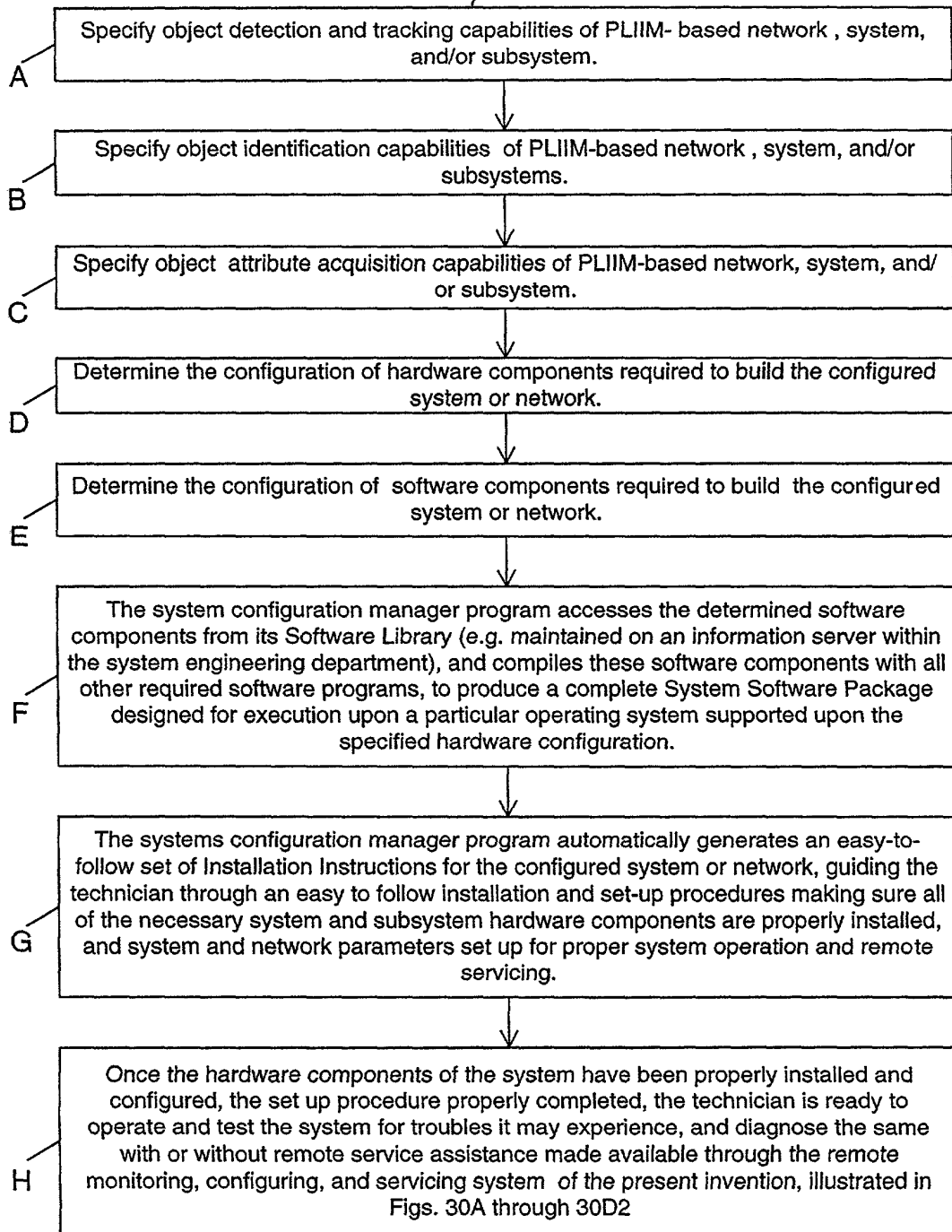


FIG. 25C

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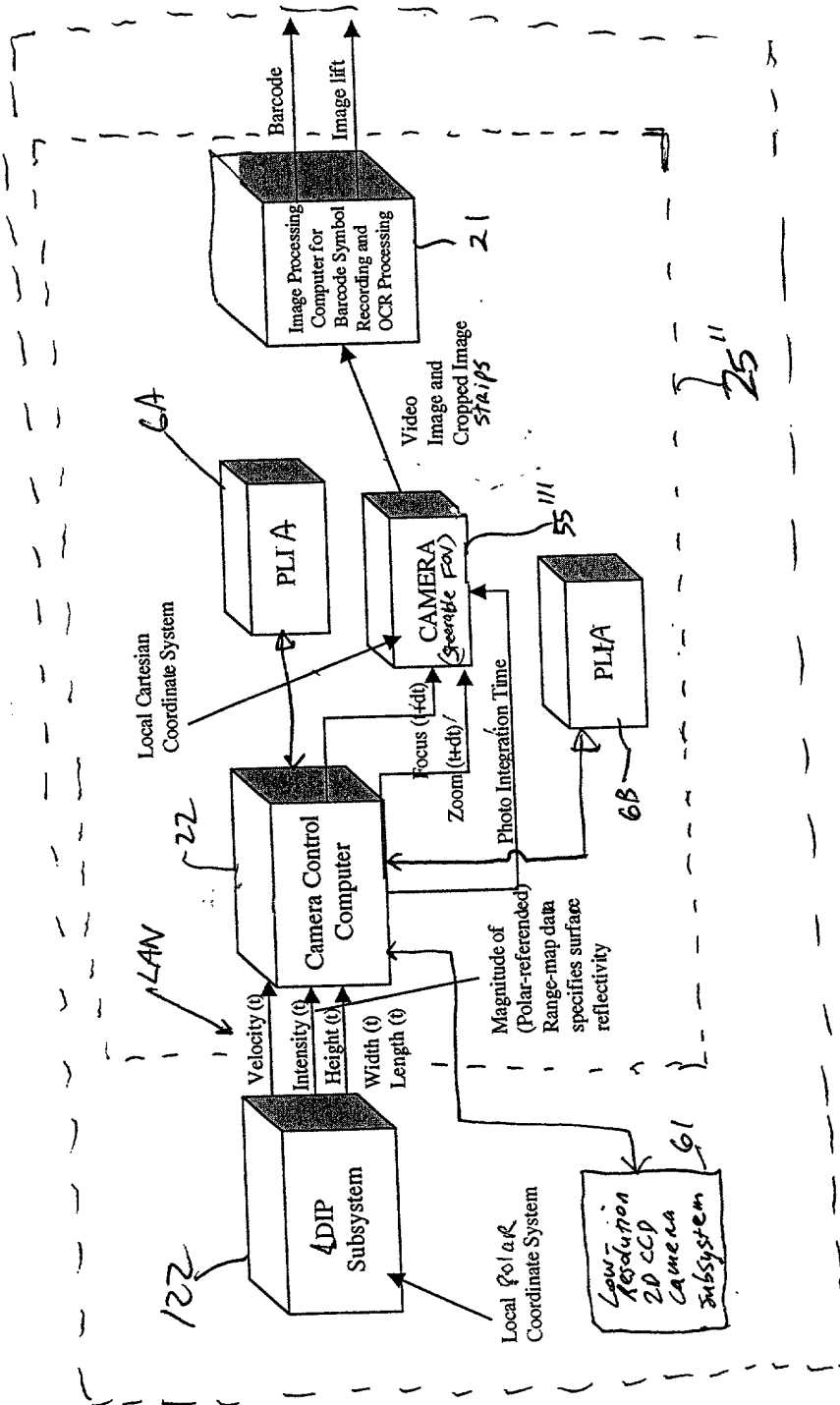
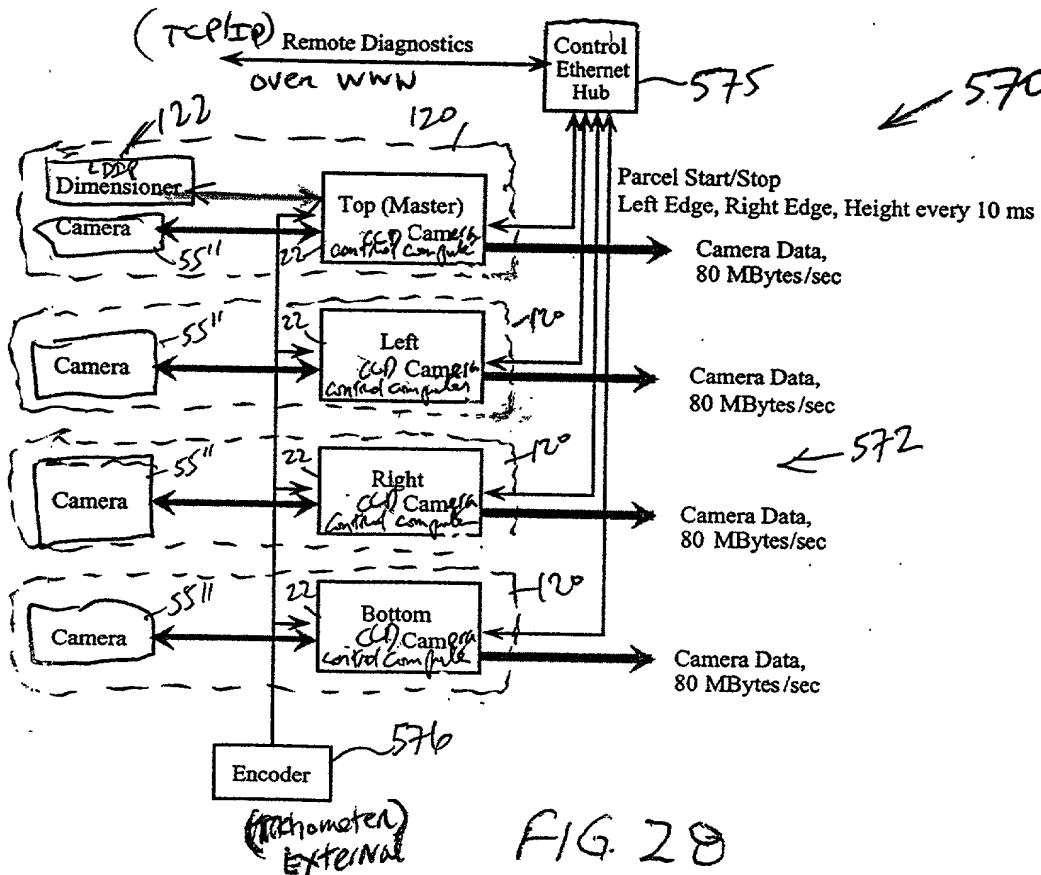
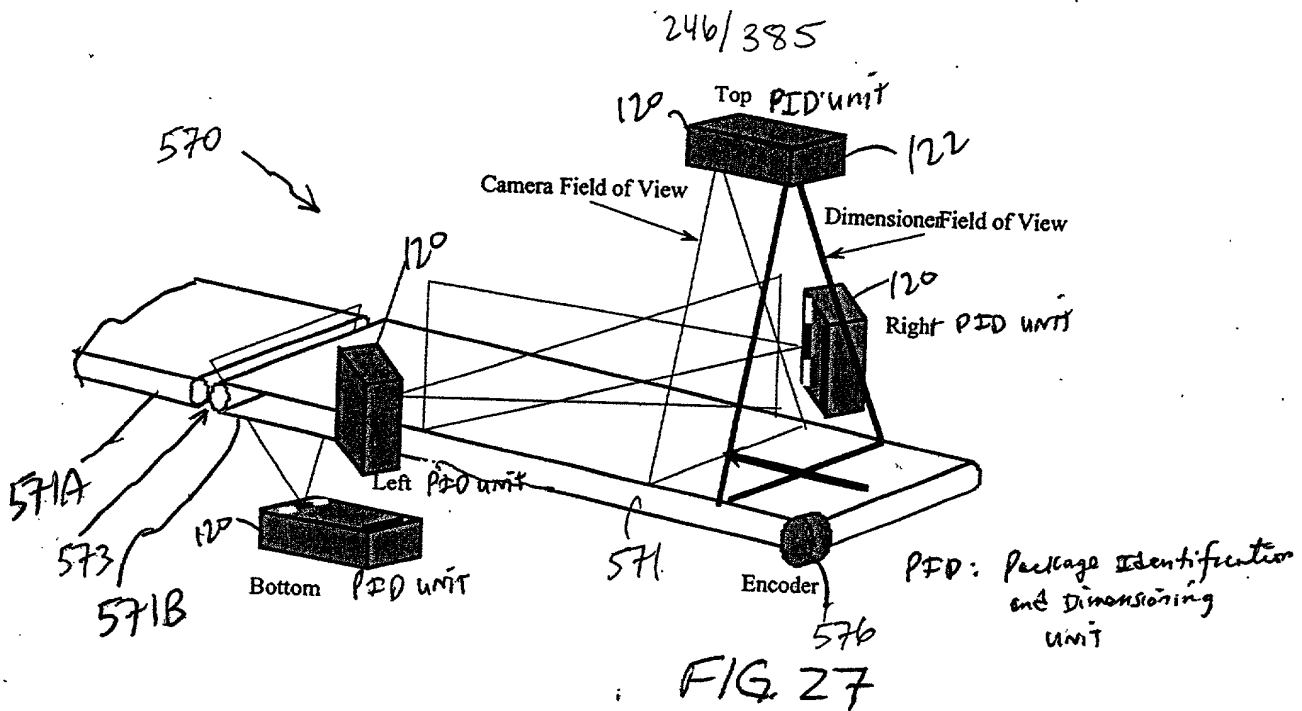
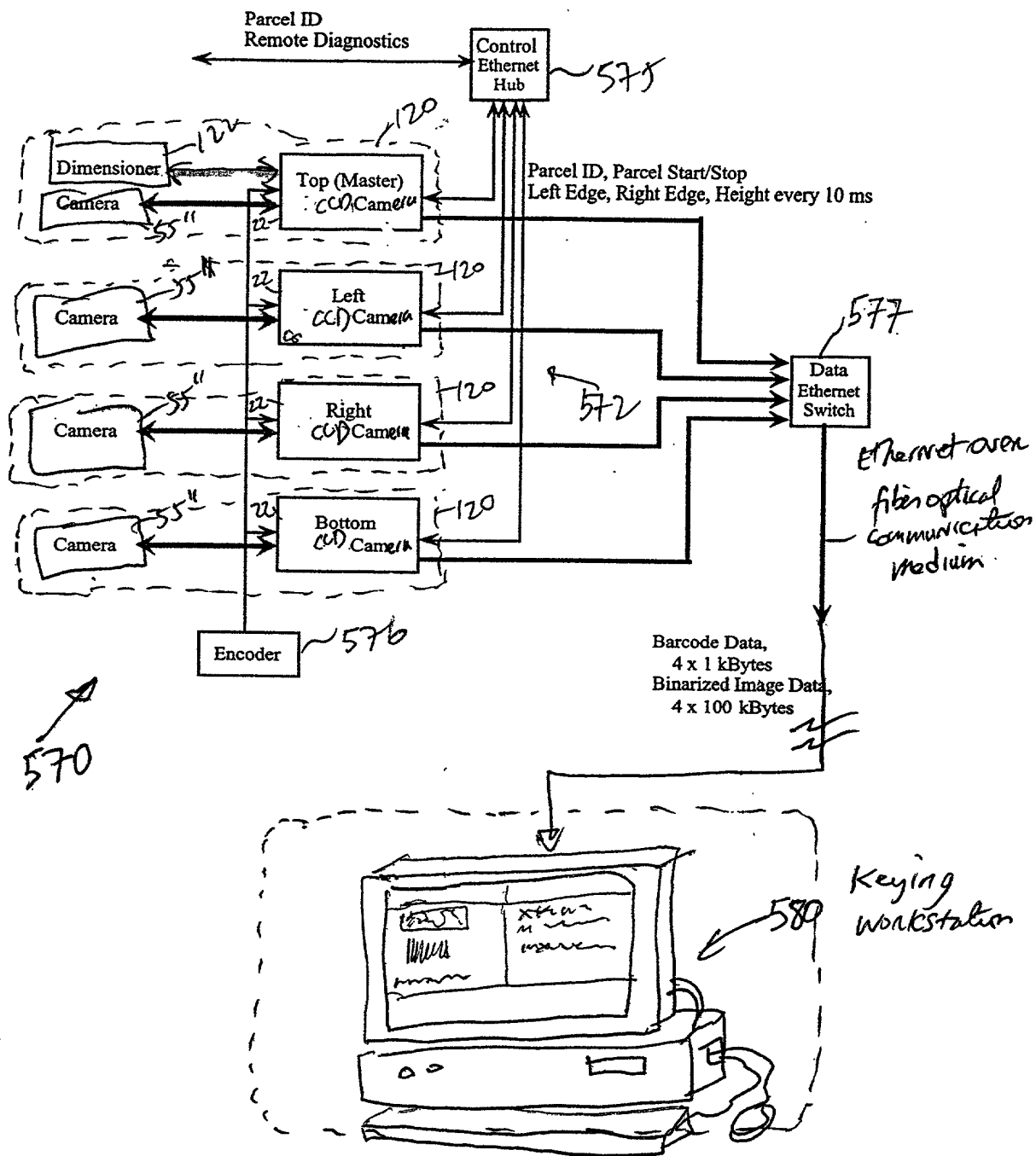


FIG. 26



[illegible]

[illegible]

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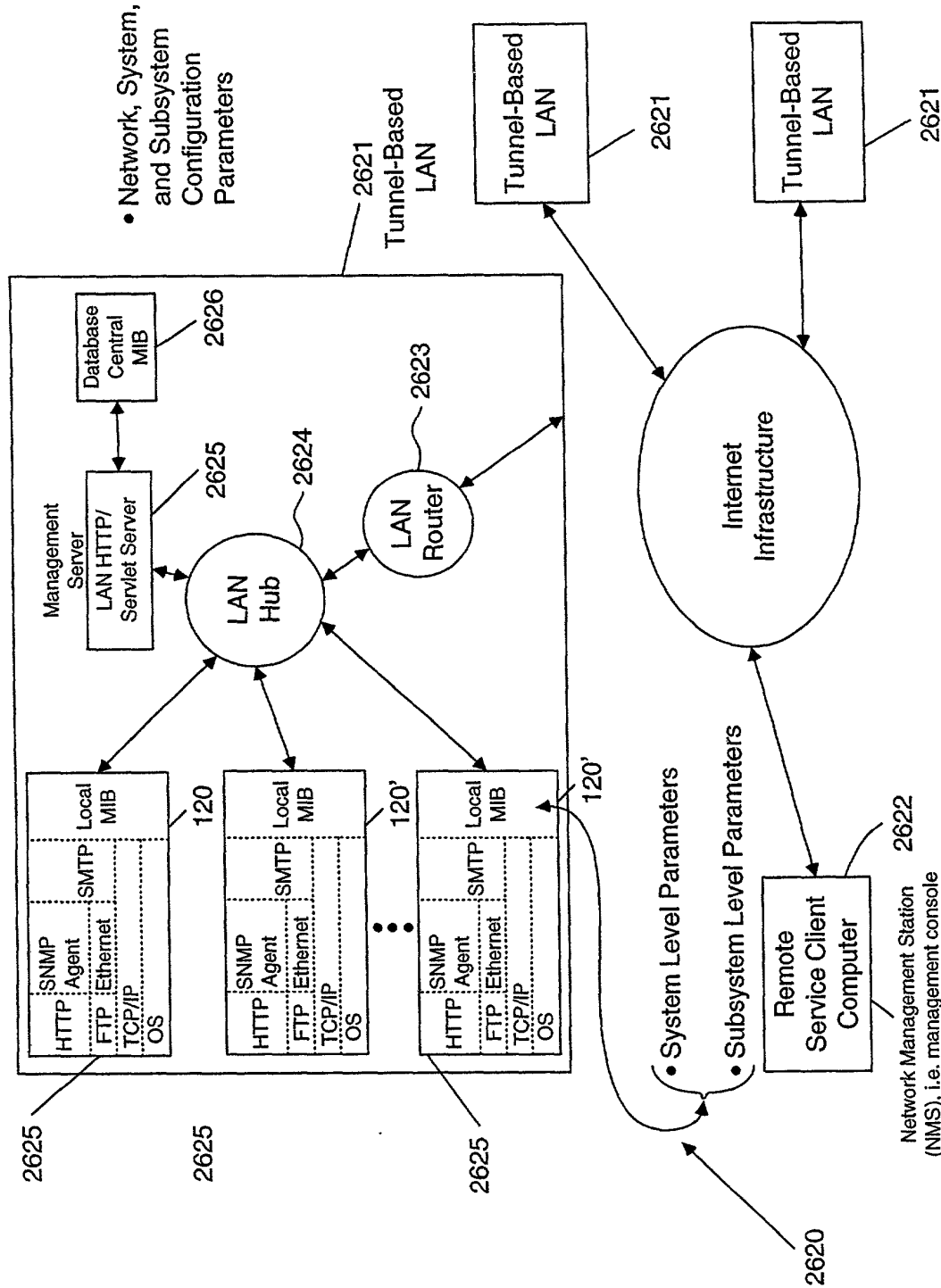


FIG. 30A

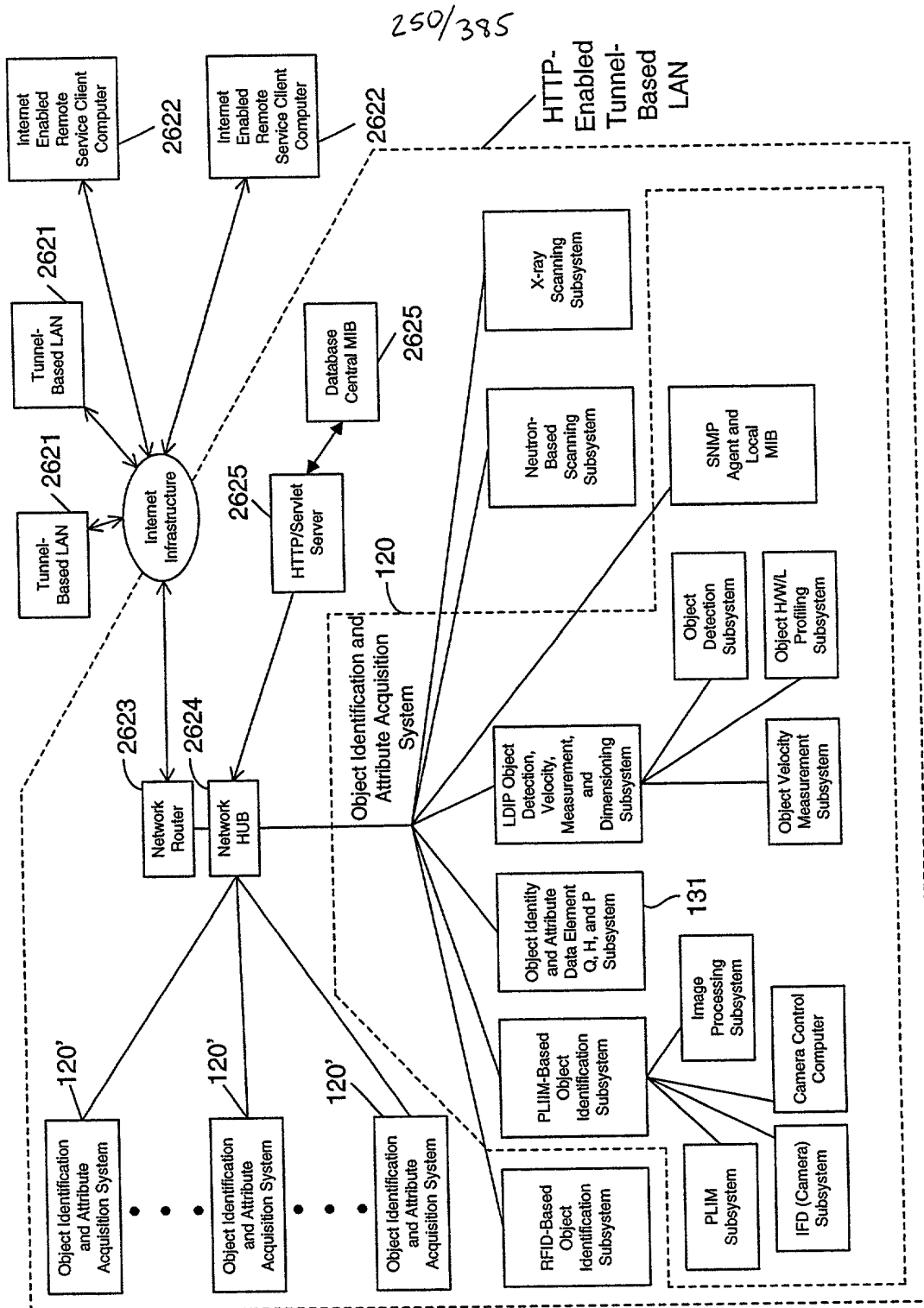


FIG. 30B

FIG. 30C

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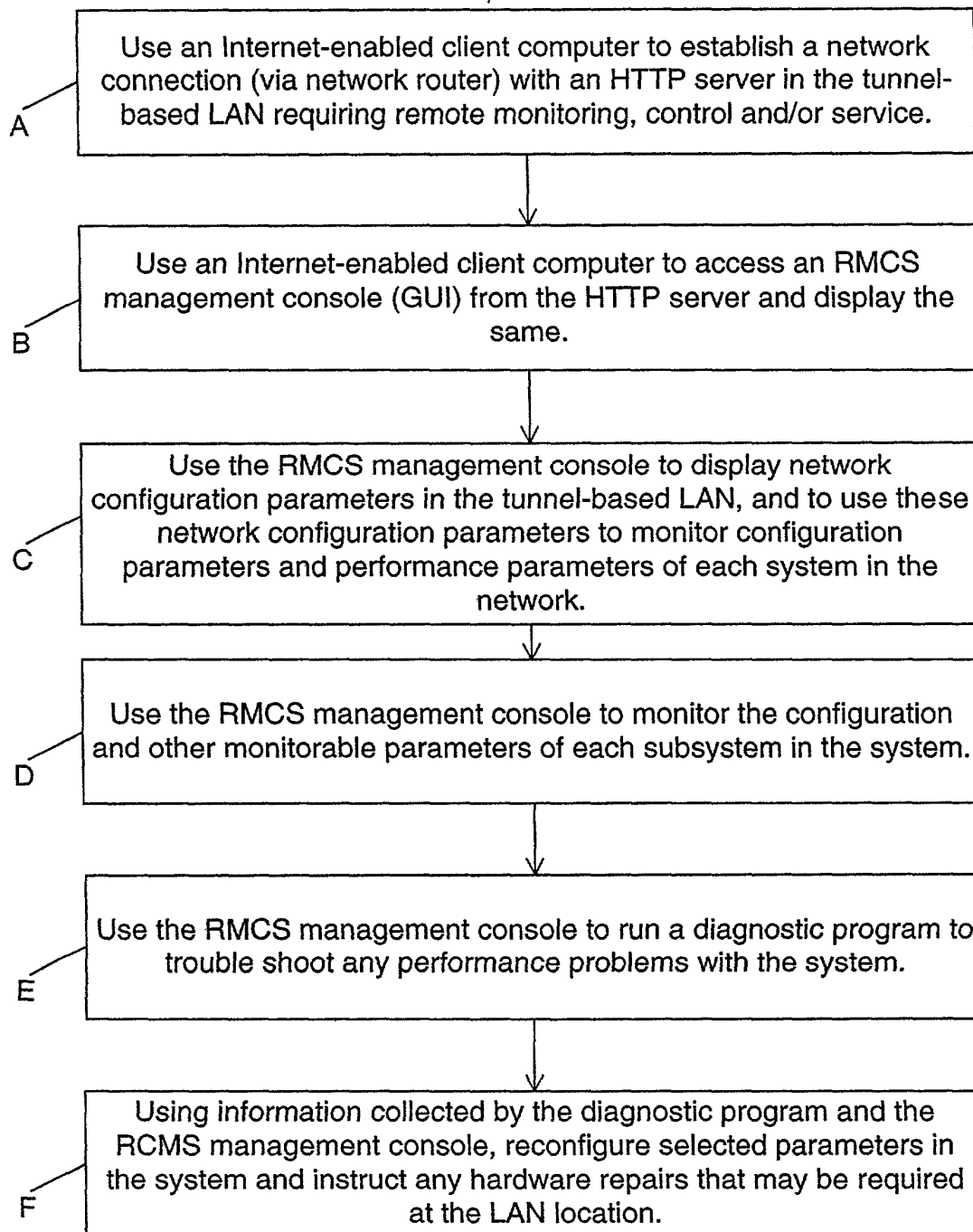


FIG. 30D1

253/385 (A)

G

Use the RMCS management console to rerun diagnostic programs on troubled systems and subsystems in the LAN after parameter reconfiguration and/or hardware repair at the LAN location, so as to test the performance of such systems and subsystems and the overall tunnel based LAN.

H

Use the RMCS management console to monitor parameters of the system and subsystems in the tunnel based LAN, from time to time, to determine whether or not the system and/or network tunnel is required.

I

Use the RMCS management console to record all monitored parameter records and result of diagnostic programs in a customer service database for future reference, and access during subsequent remote service calls over the Internet.

FIG. 30D2

CCD Camera-Based Tunnel System
Employing Package Coordinate Data
Driven Method of Automatic Camera
Zoom and Focus Control

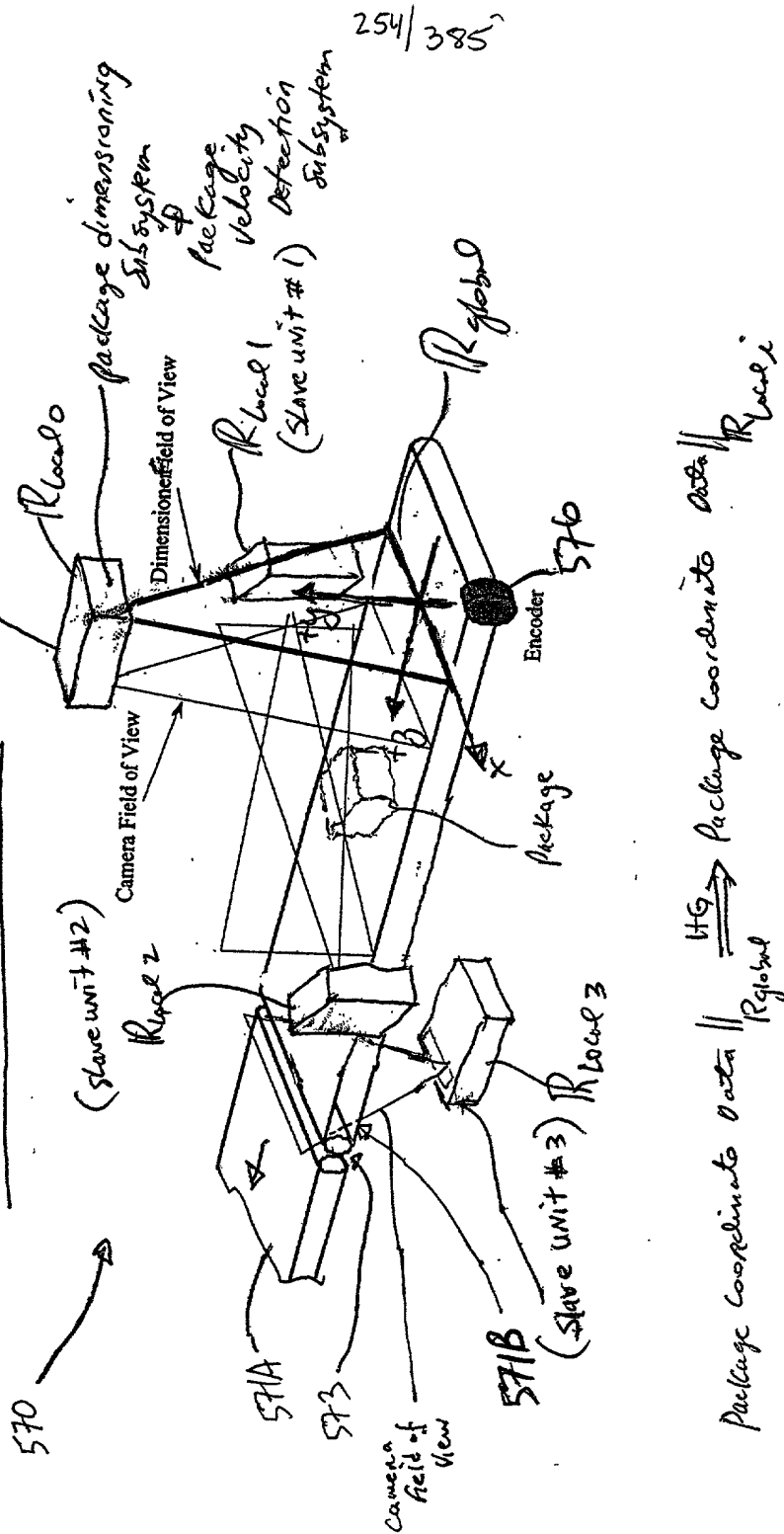


FIG. 31

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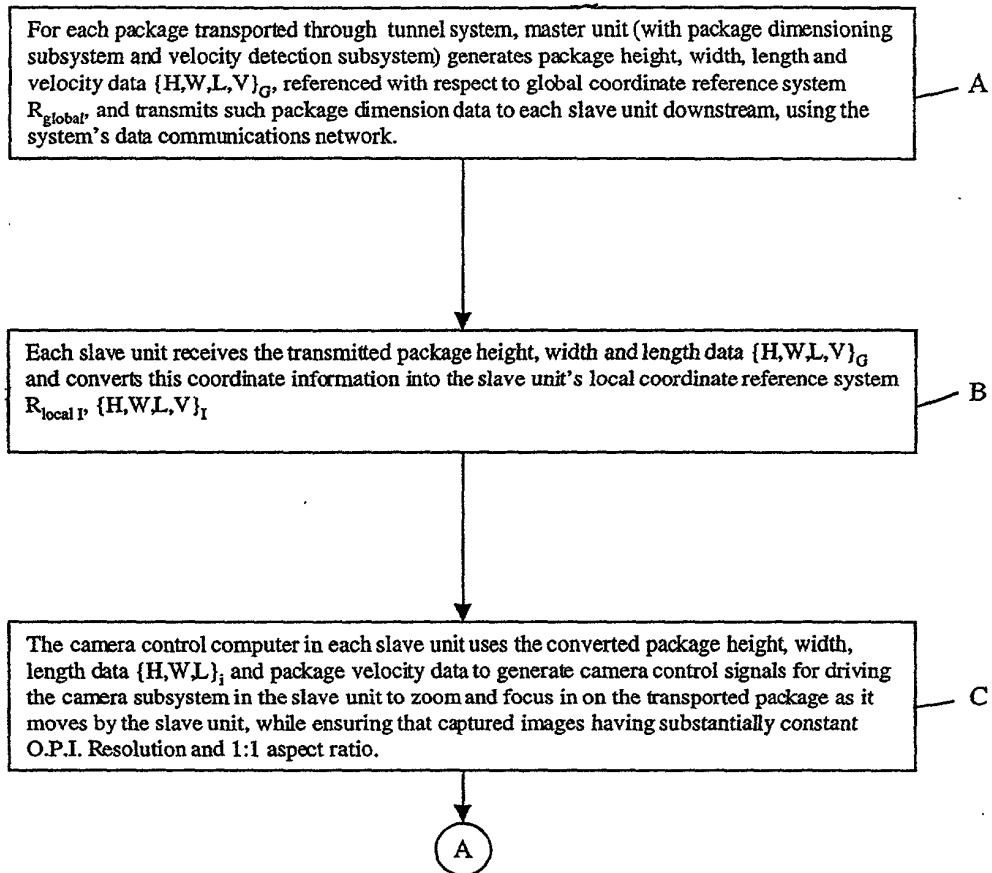


FIG. 32A

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(A)

256/385

Each slave unit captures images acquired by its intelligently controlled camera subsystem, buffers the same, and processes the images to decode bar code symbol identifiers represented in said images, and/or to perform optical character recognition (OCR) thereupon.

D

The slave unit which decodes a bar code symbol in a processed image automatically transmits a package identification data element (containing symbol character data representative of the decoded bar code symbol) to the master unit (or other designated system control unit employing data element management functionalities) for package data element processing.

E

Master unit time-stamps received package identification data element, places said data element in a data queue, and processes package identification data elements and time-stamped package dimension data elements in said queue to link each package identification data element with one said corresponding package dimension data element.

F

FIG. 32B

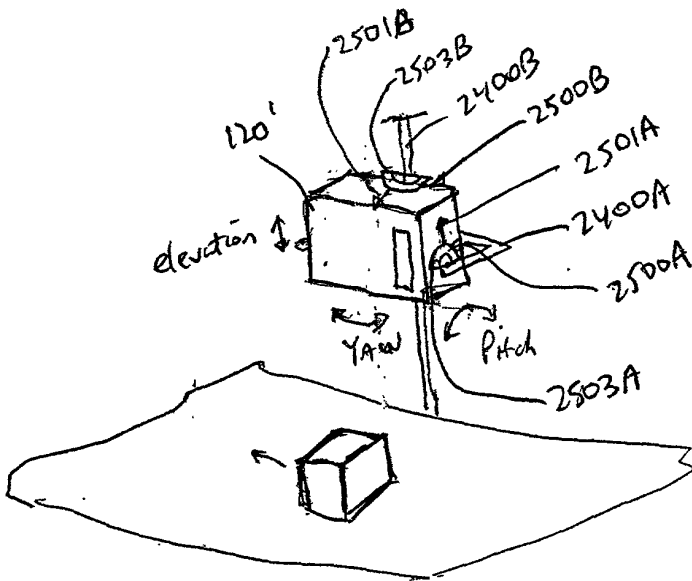


FIG. 31A

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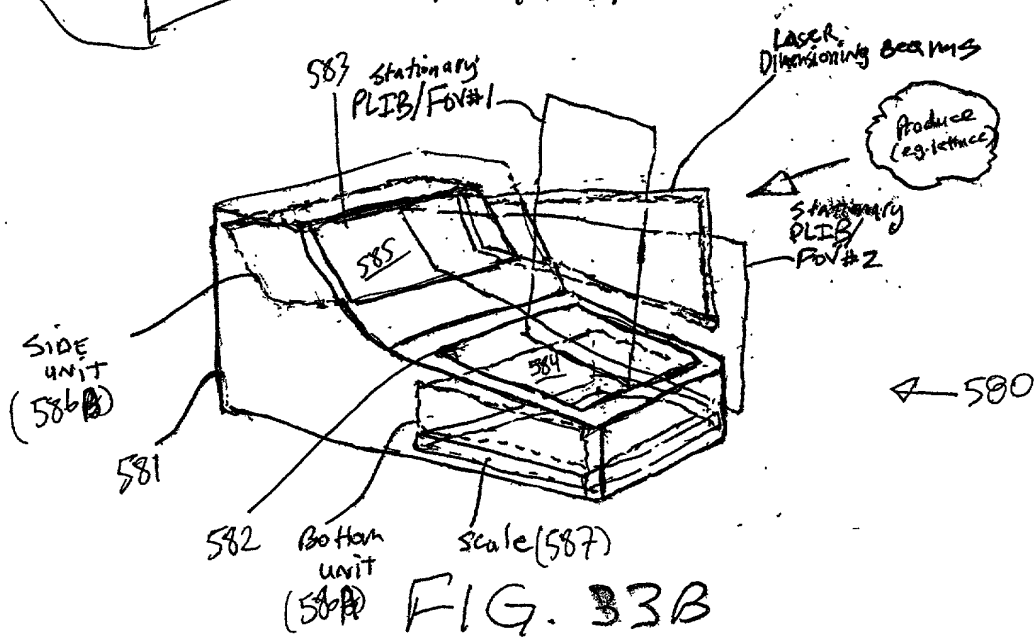
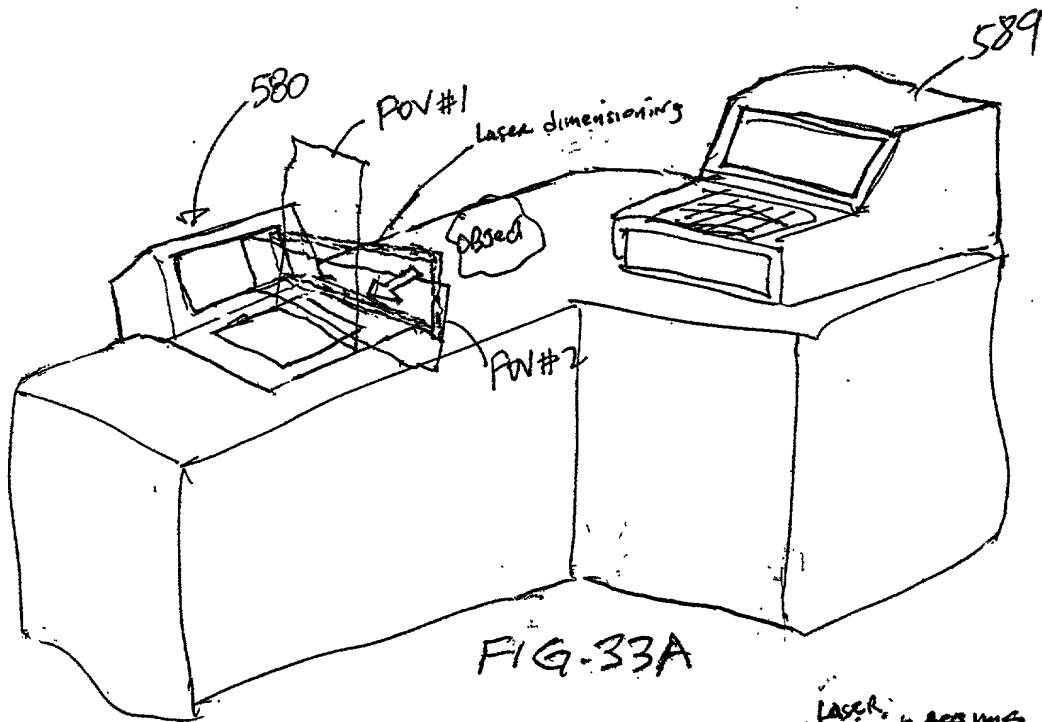




FIG. 33C

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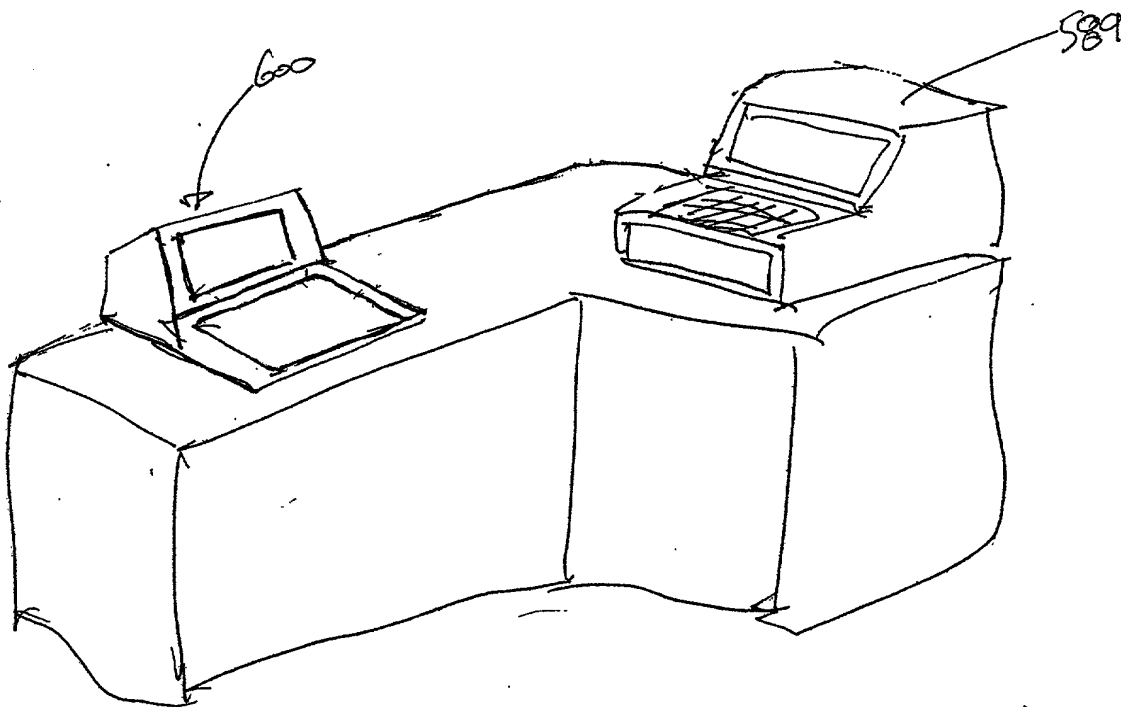


FIG. 34A

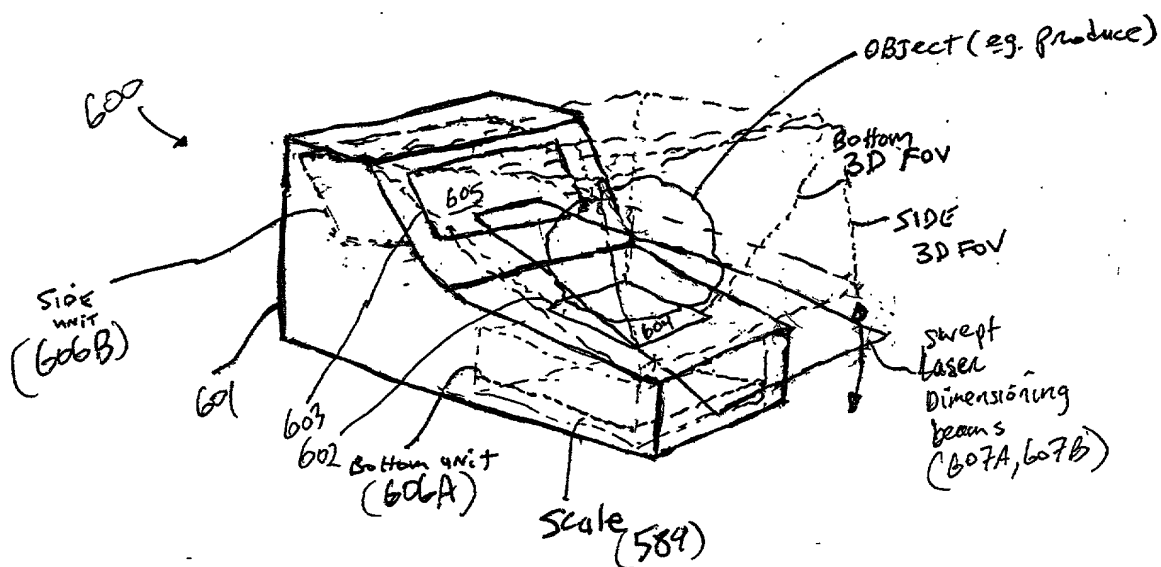


FIG. 34B

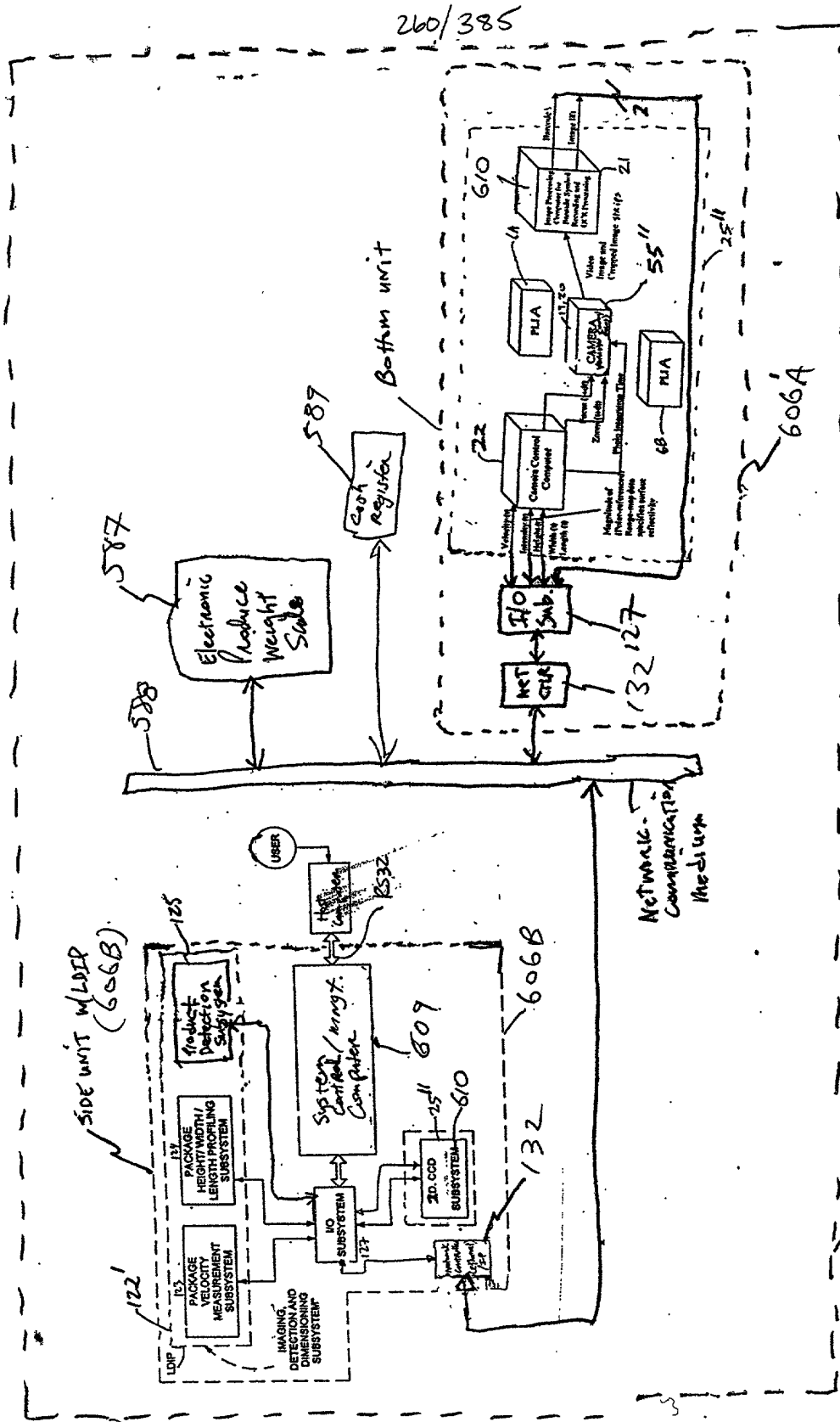
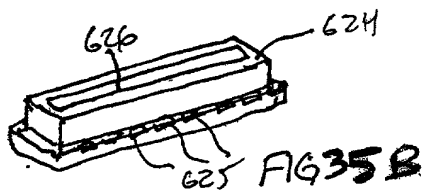
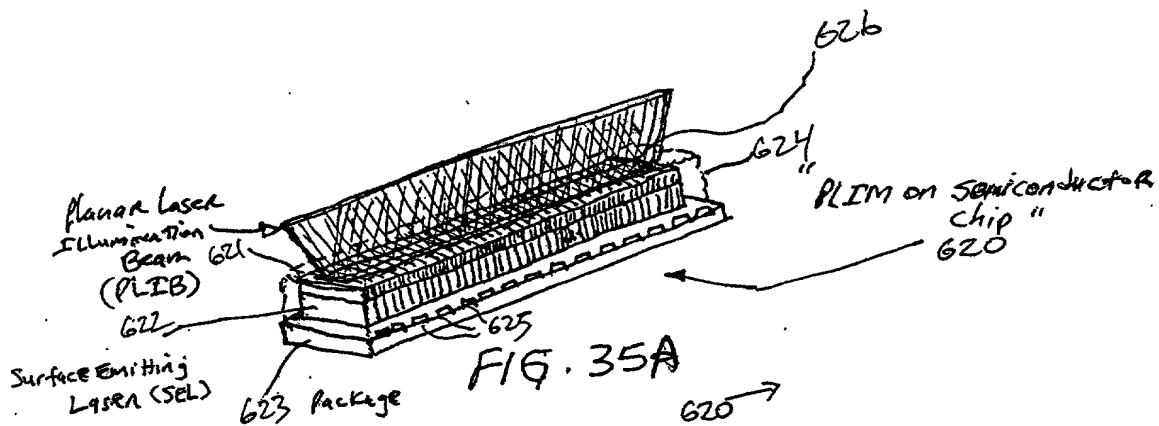
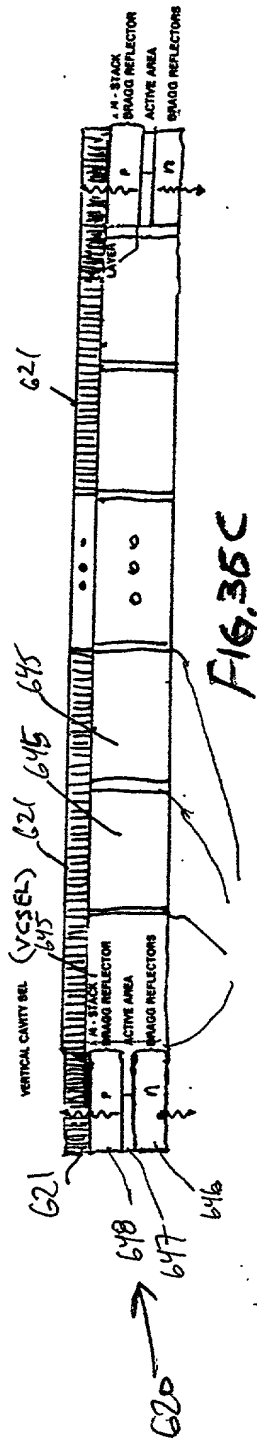
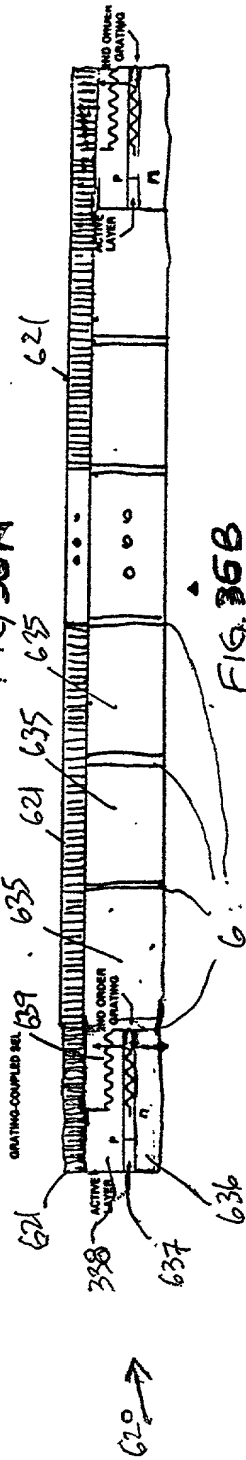
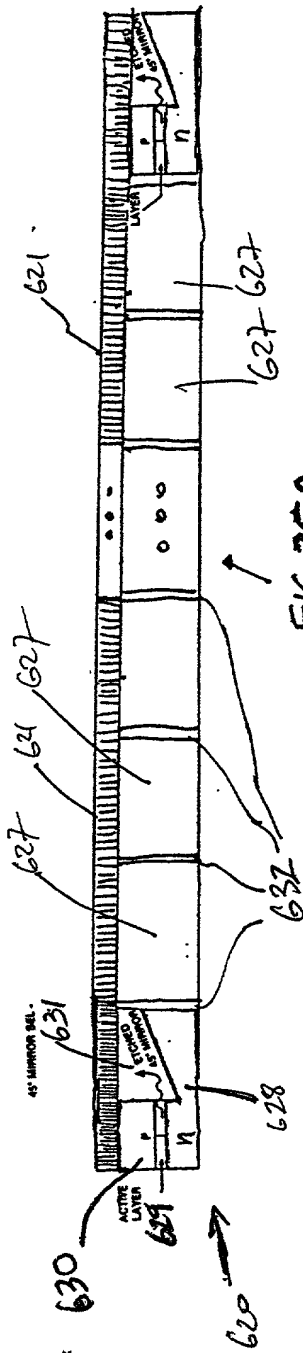


FIG. 34C

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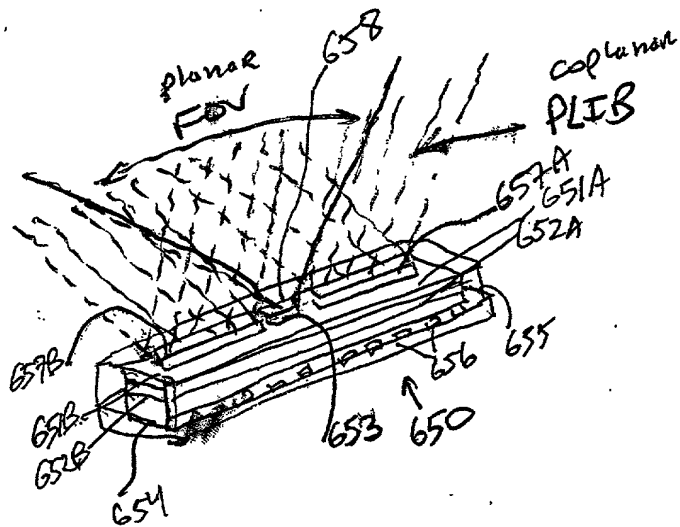


FIG. 37

00000585 42404

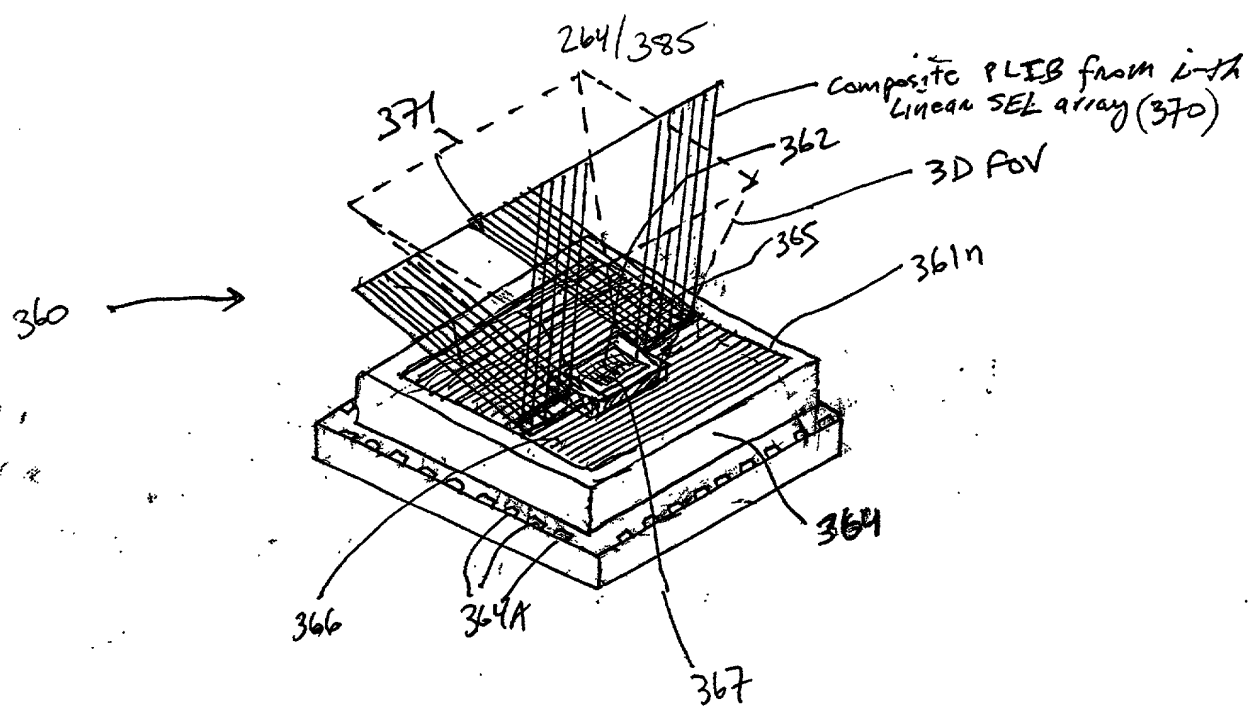


FIG. 38A

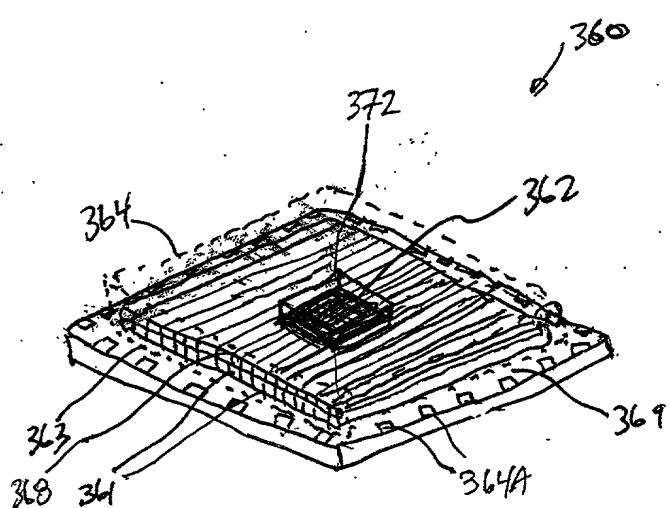


FIG. 38B

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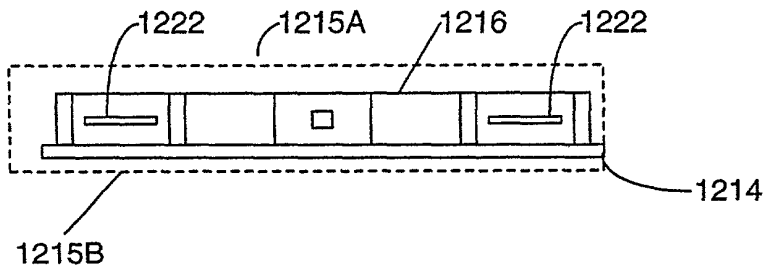


FIG. 39D

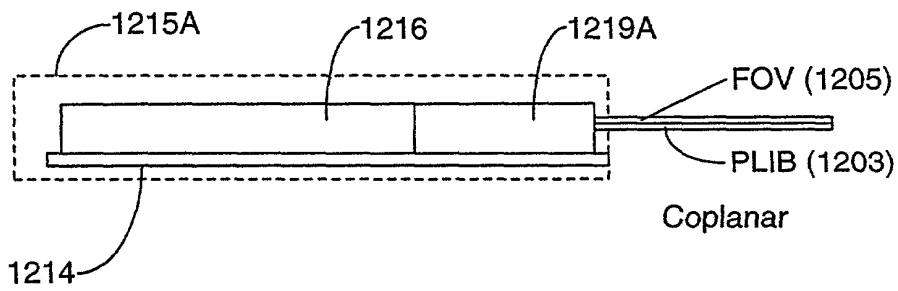


FIG. 39E

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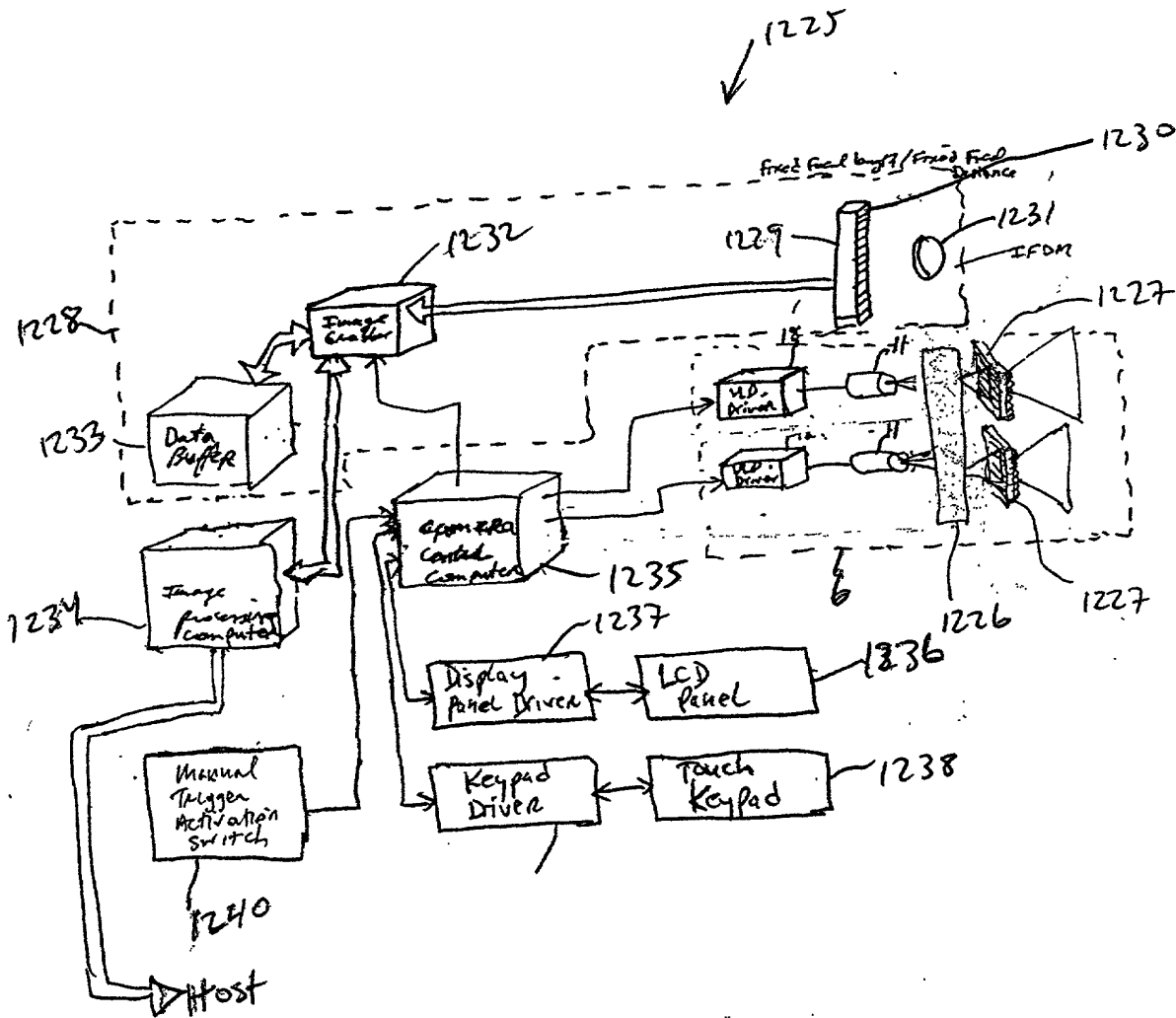
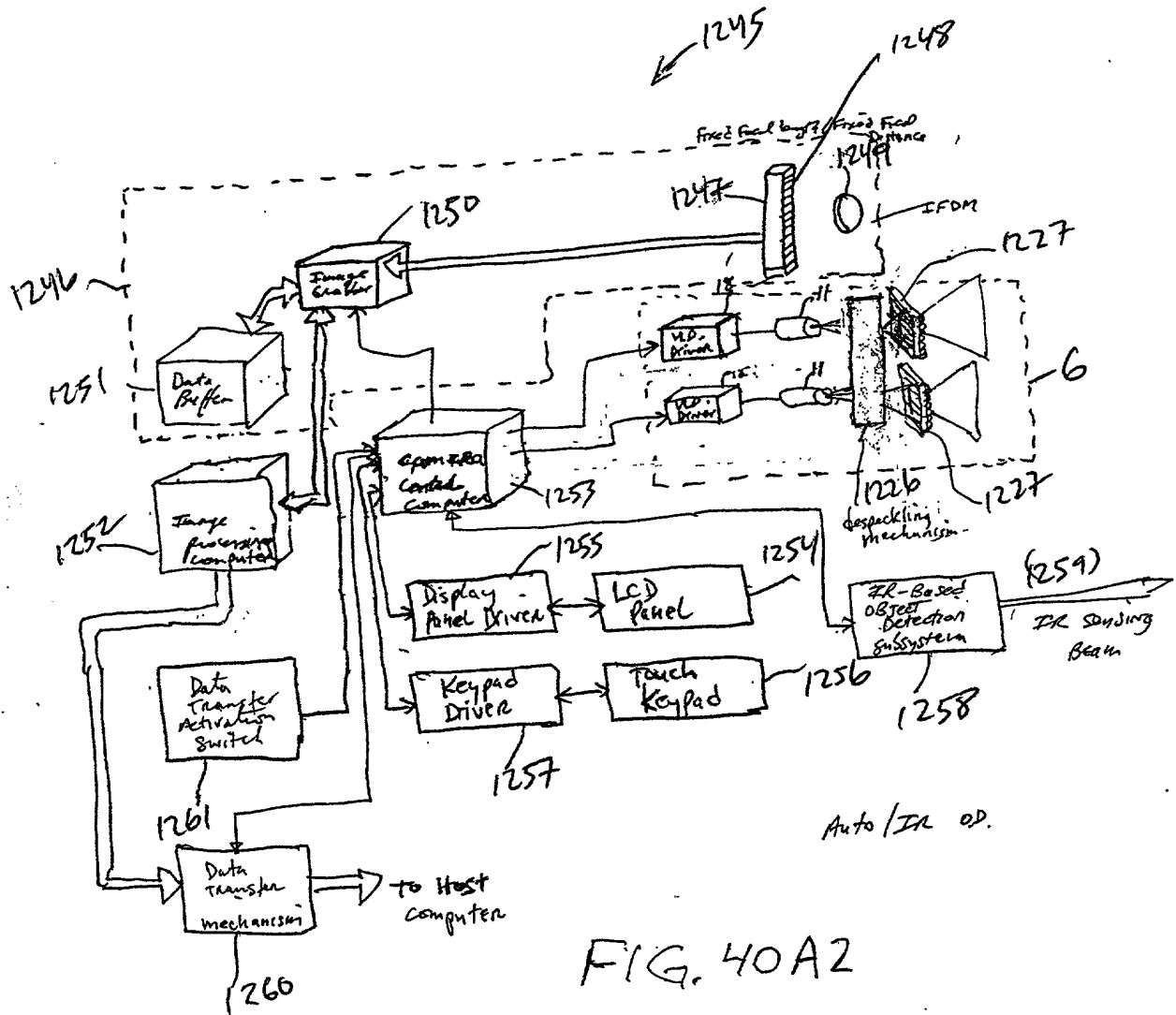
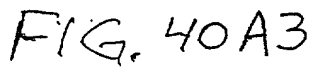


FIG. 40A1

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[illegible]

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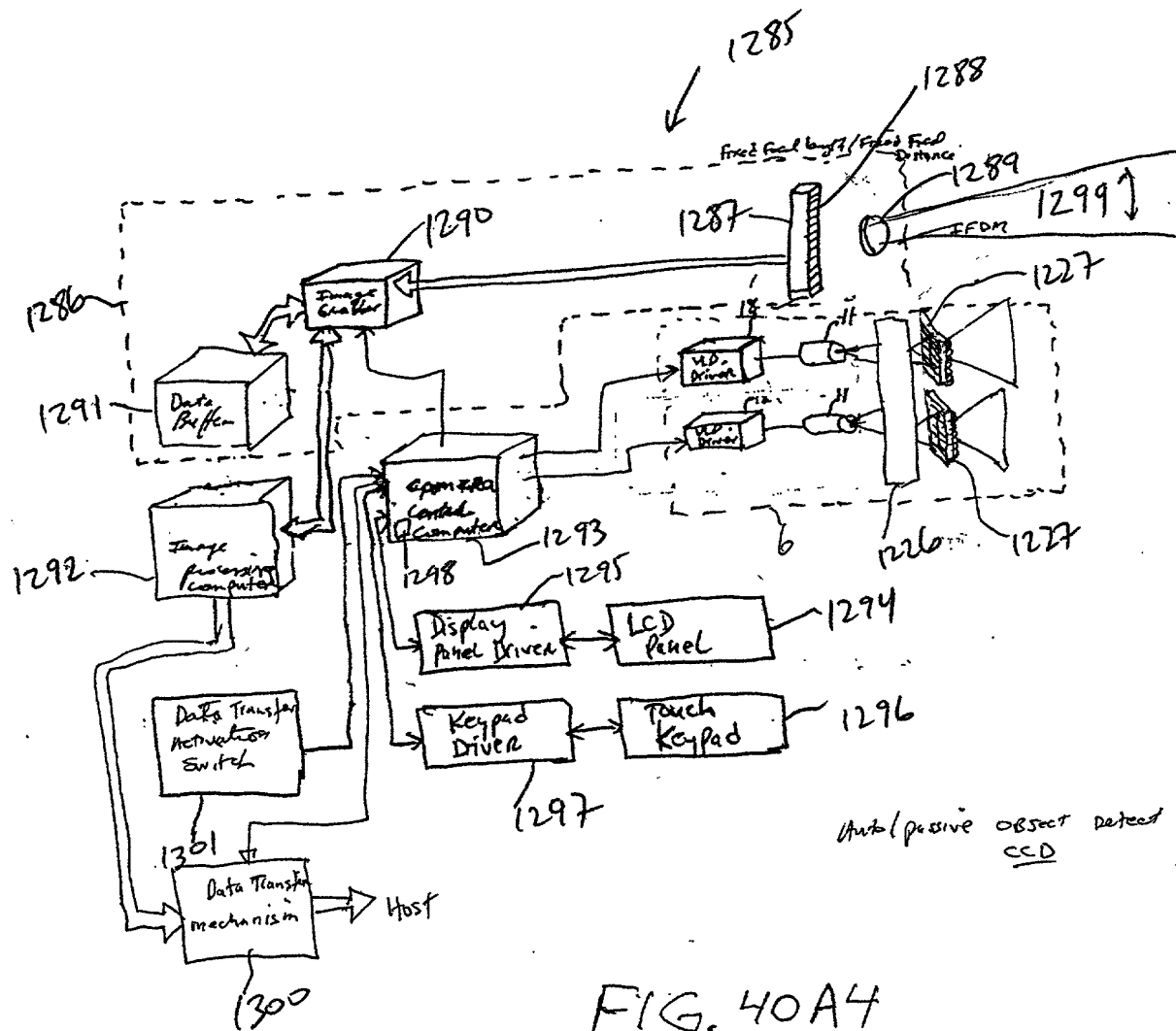


FIG. 40A4

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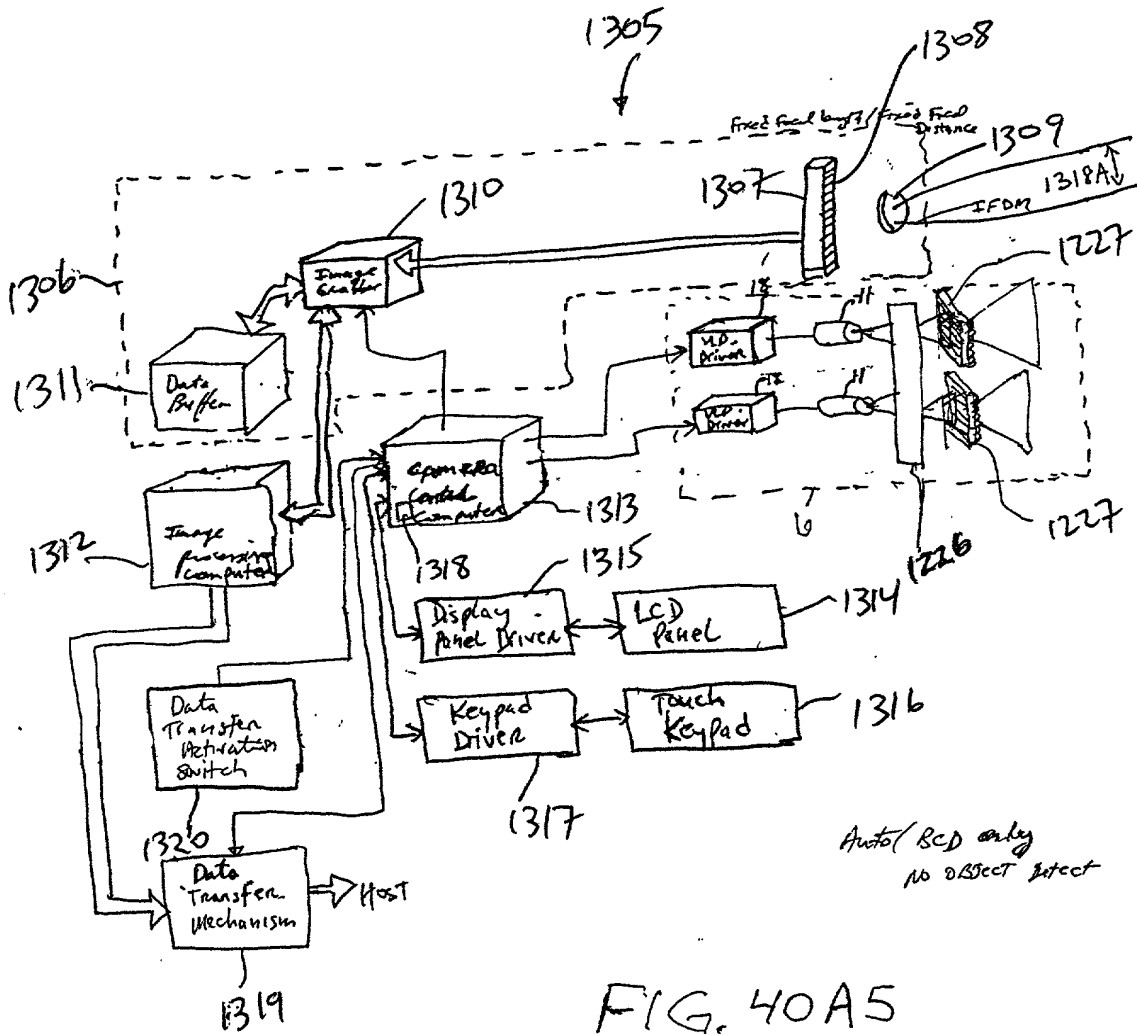


FIG. 40A5

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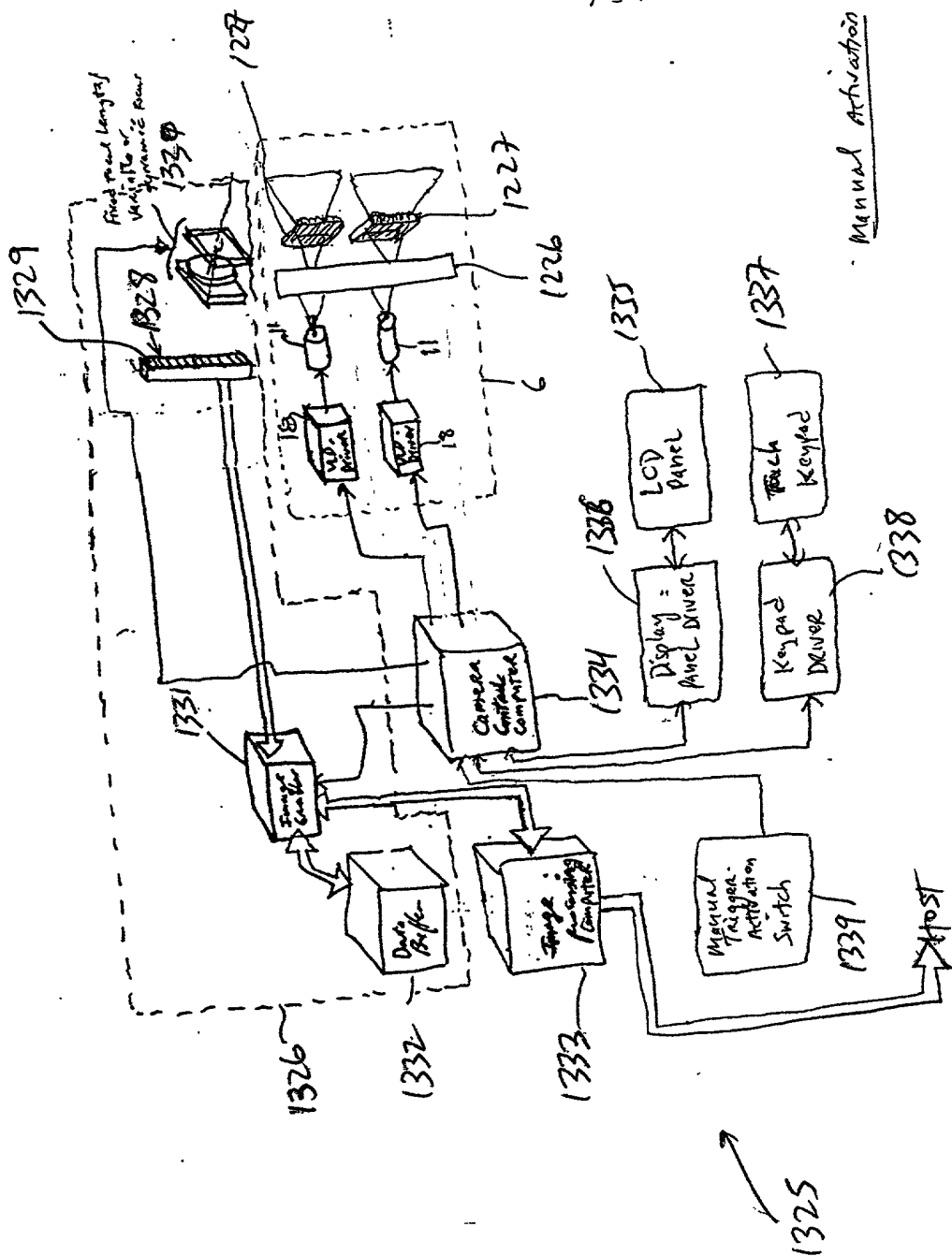
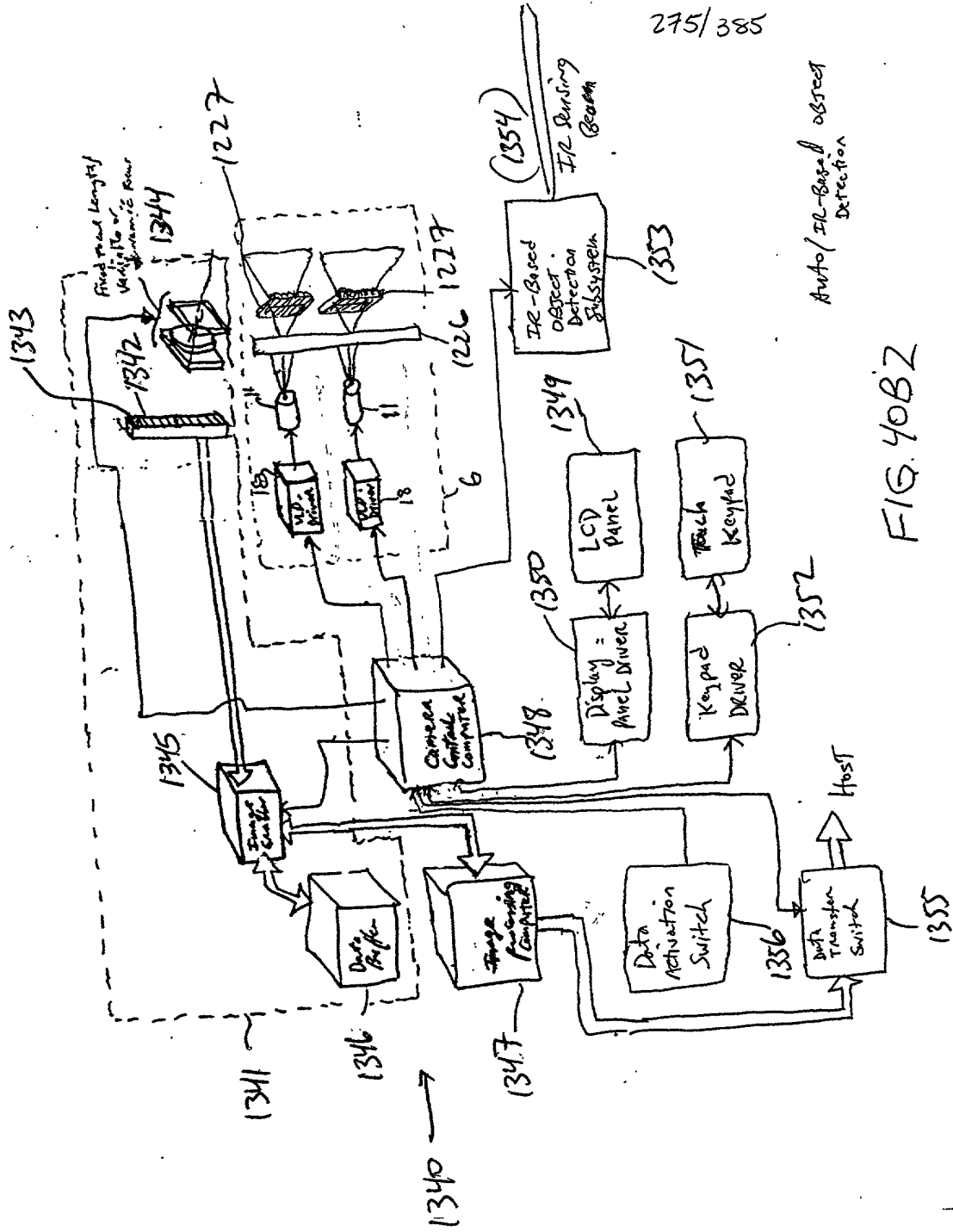


FIG. 40B1



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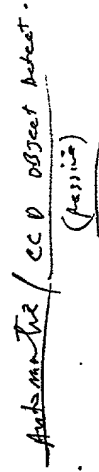


FIG. 40B.4

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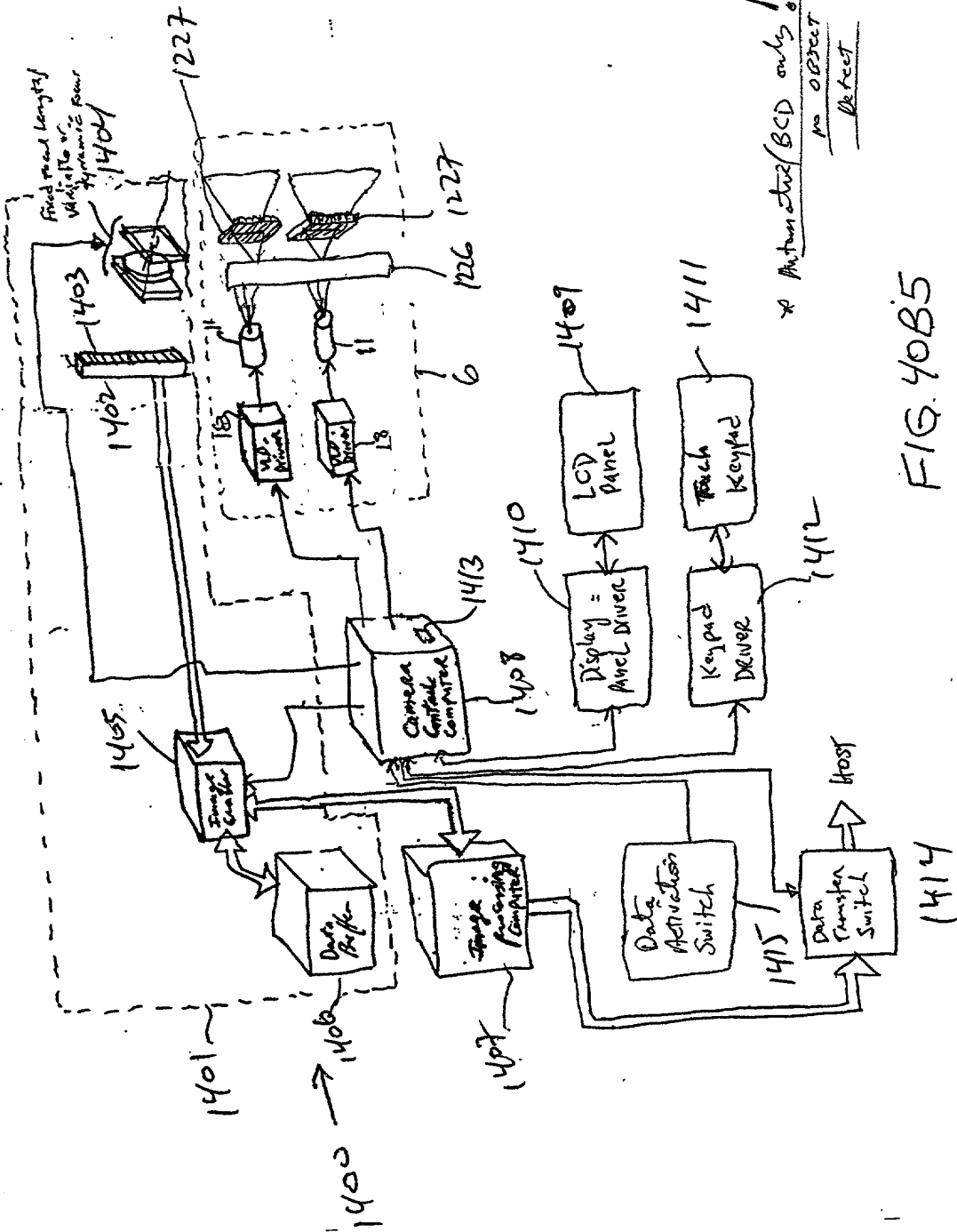


FIG. 40B5

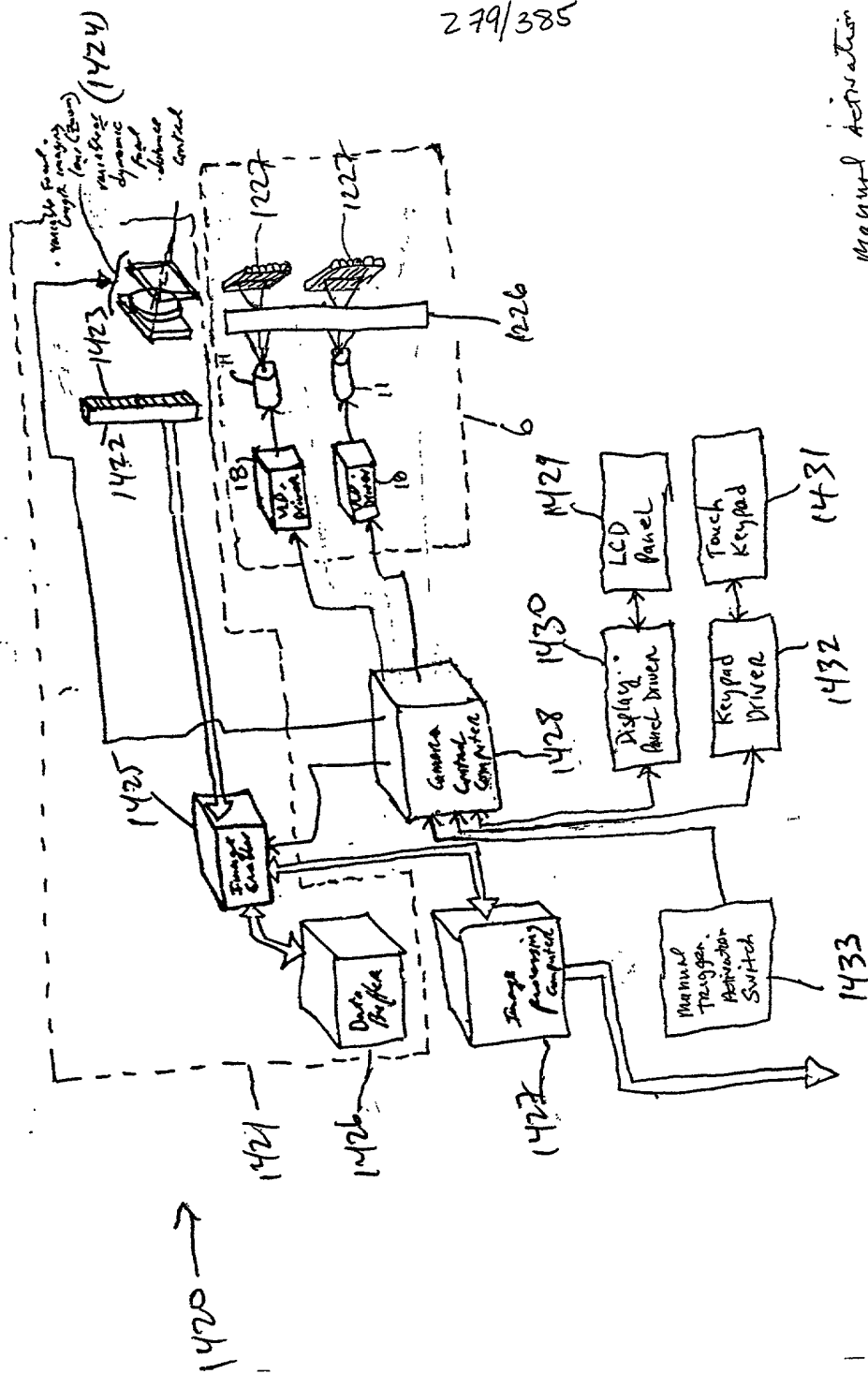
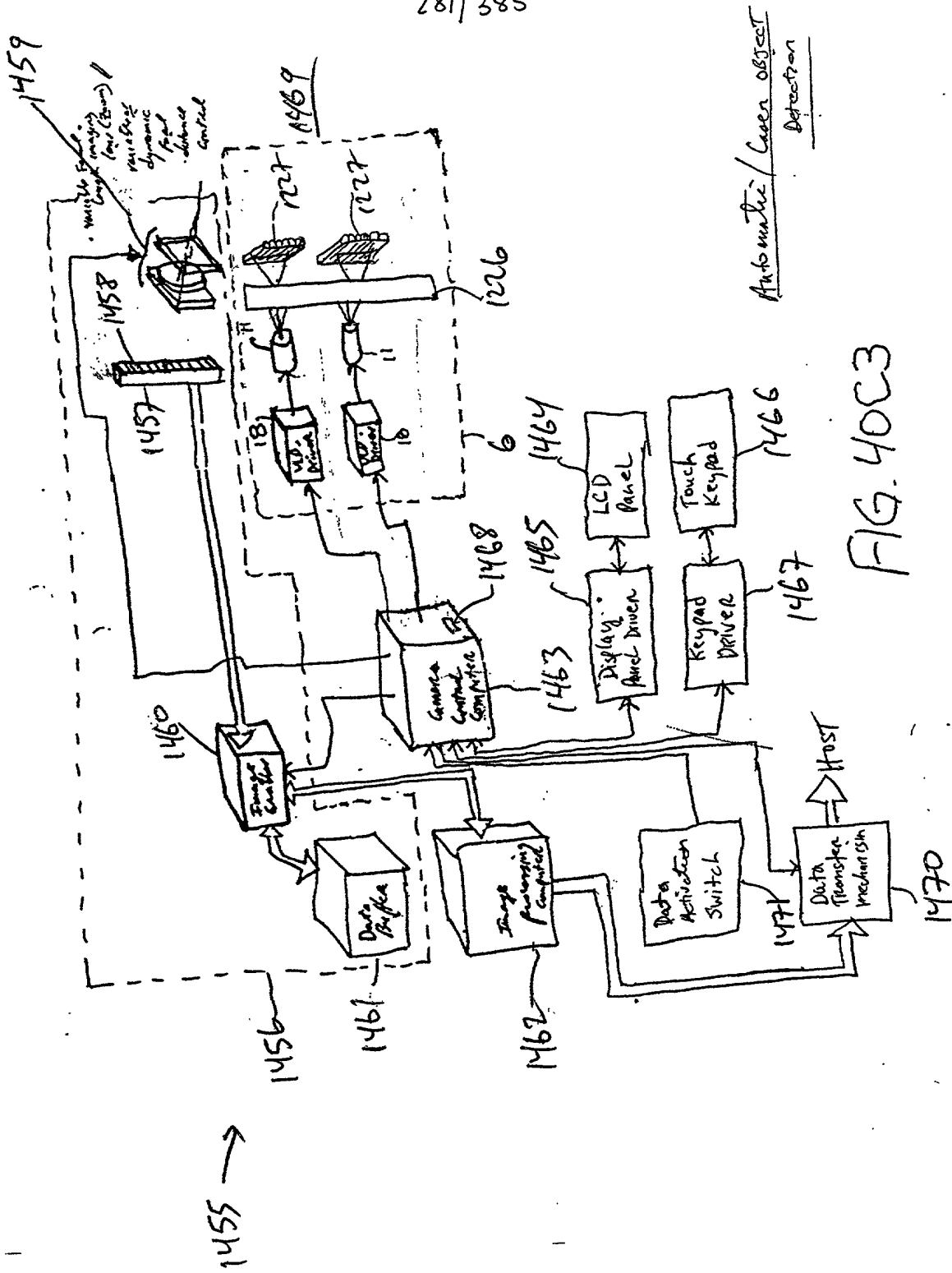
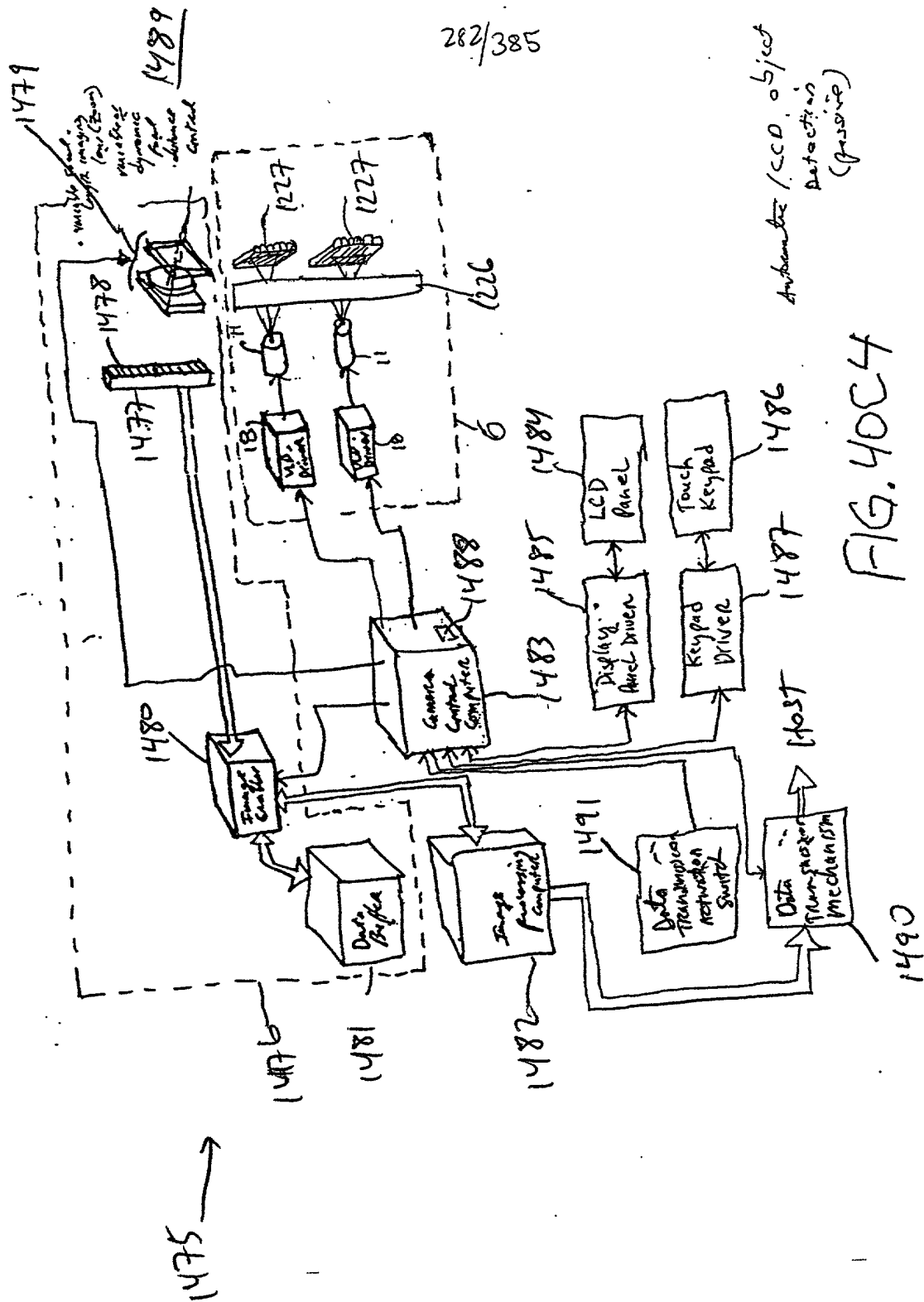


FIG. 40C1

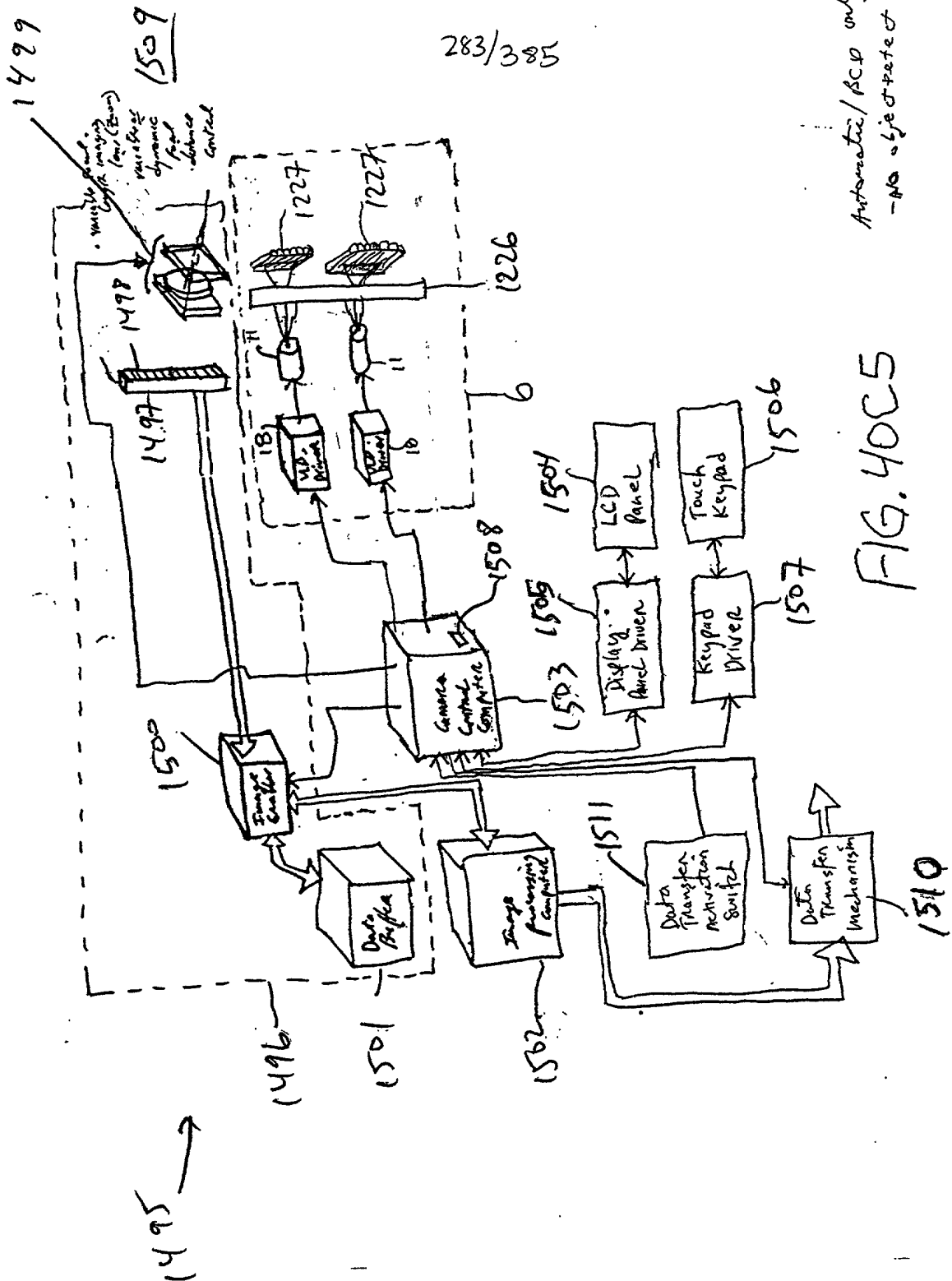
Manual Activation



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Automatic/BCP only
-No object detect



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1-D
display
...

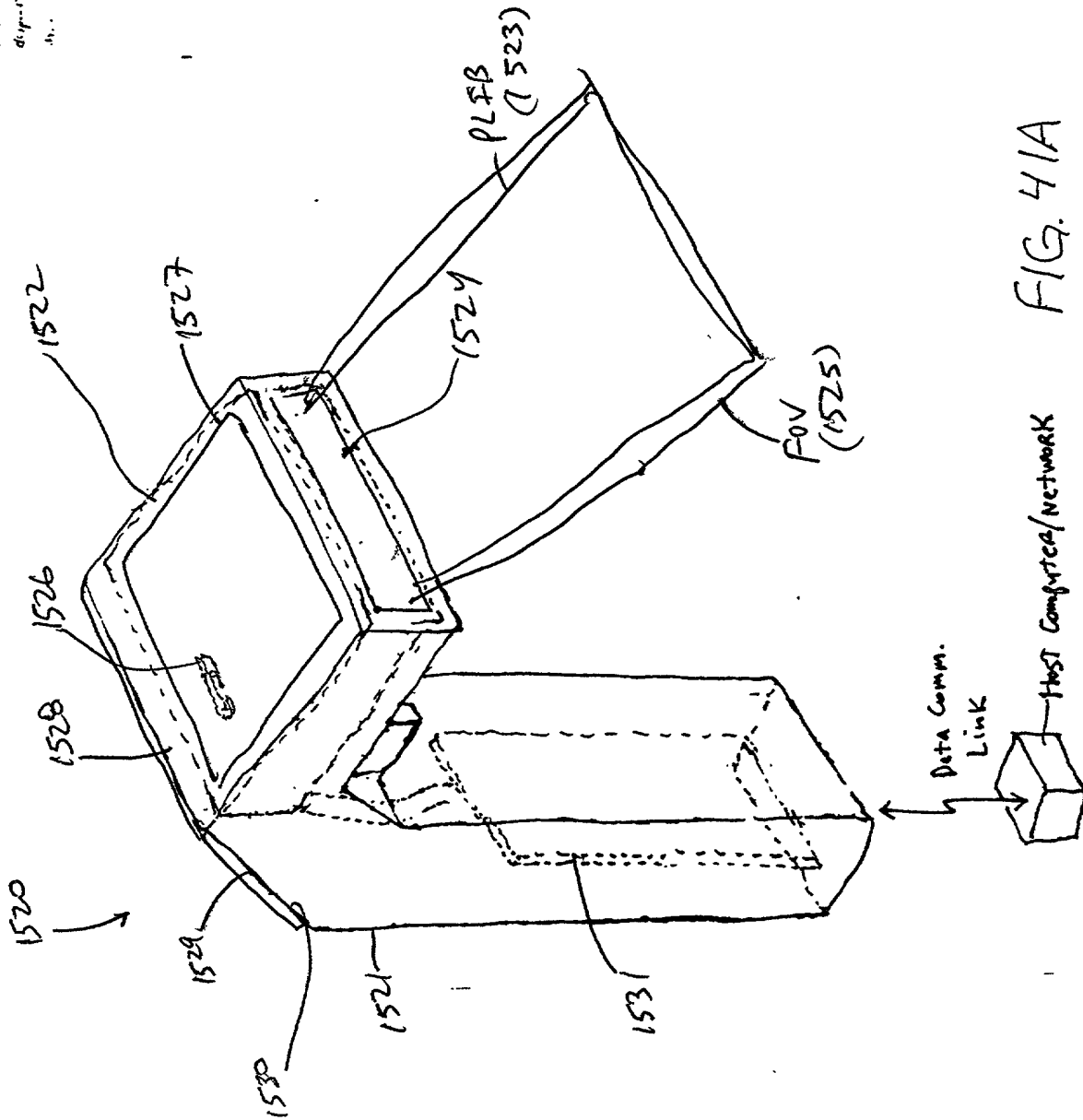


FIG. 41A

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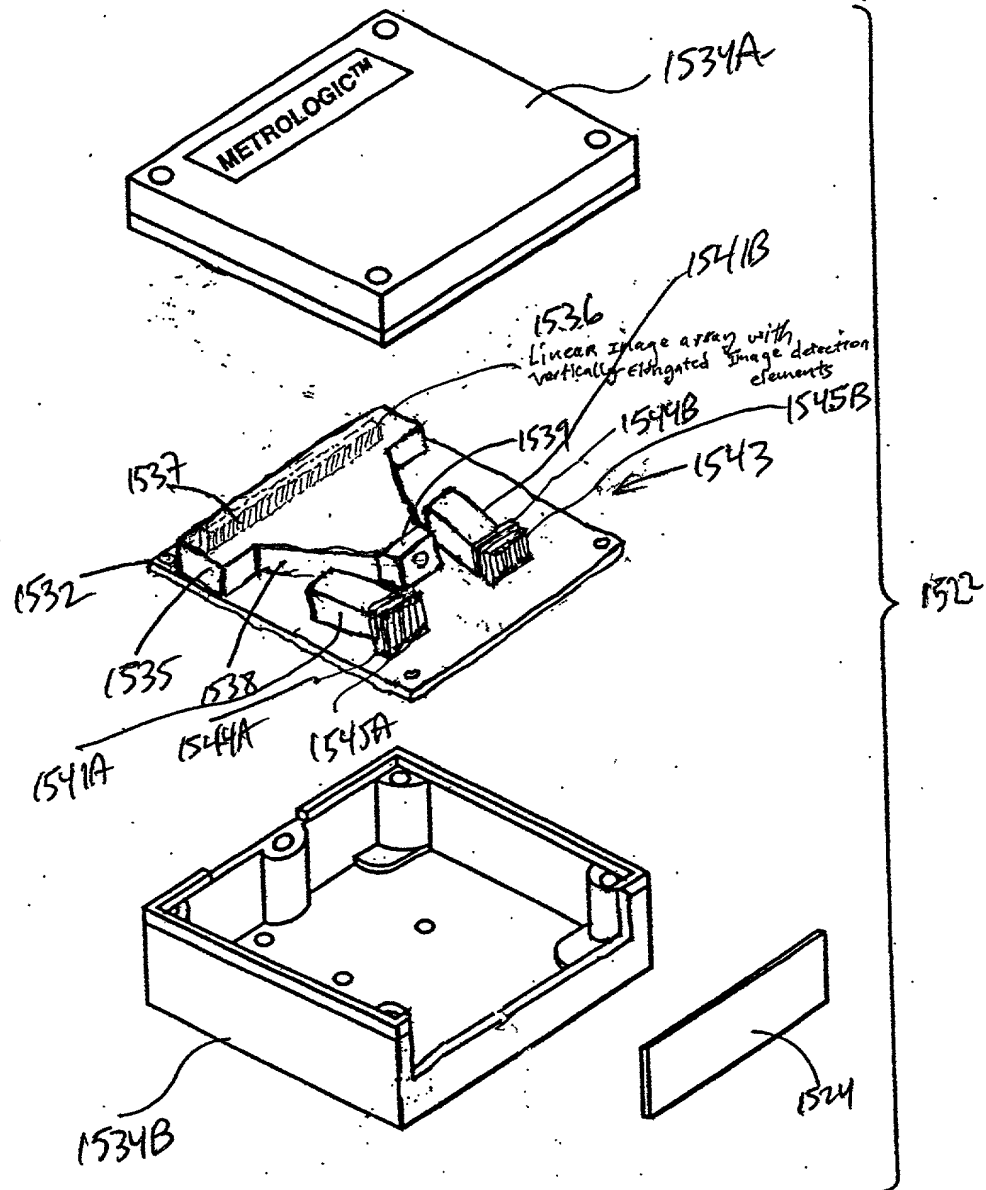


FIG. 41B

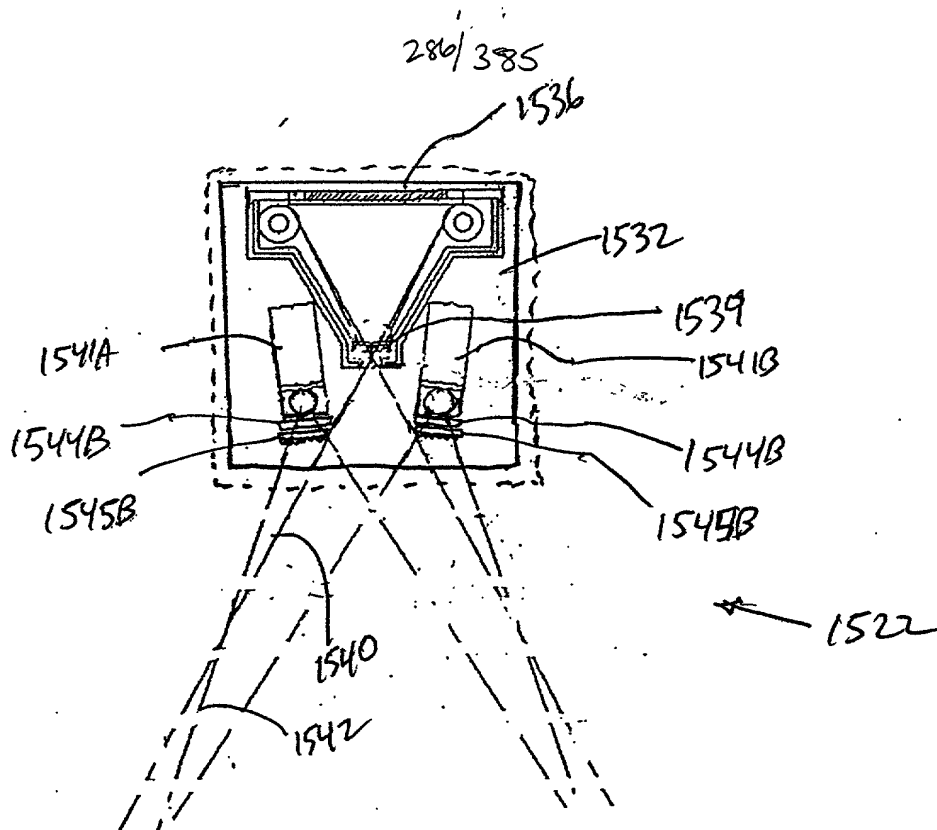


FIG. 41C

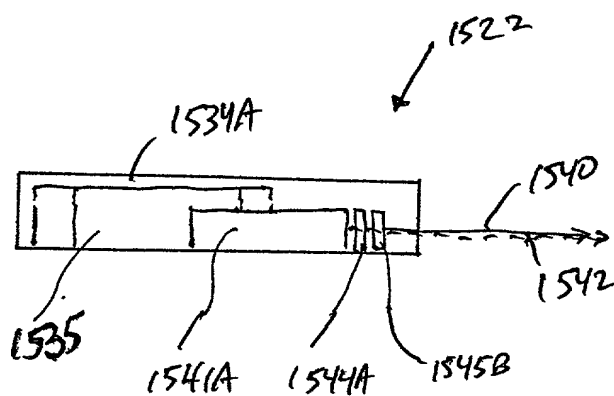


FIG. 41D

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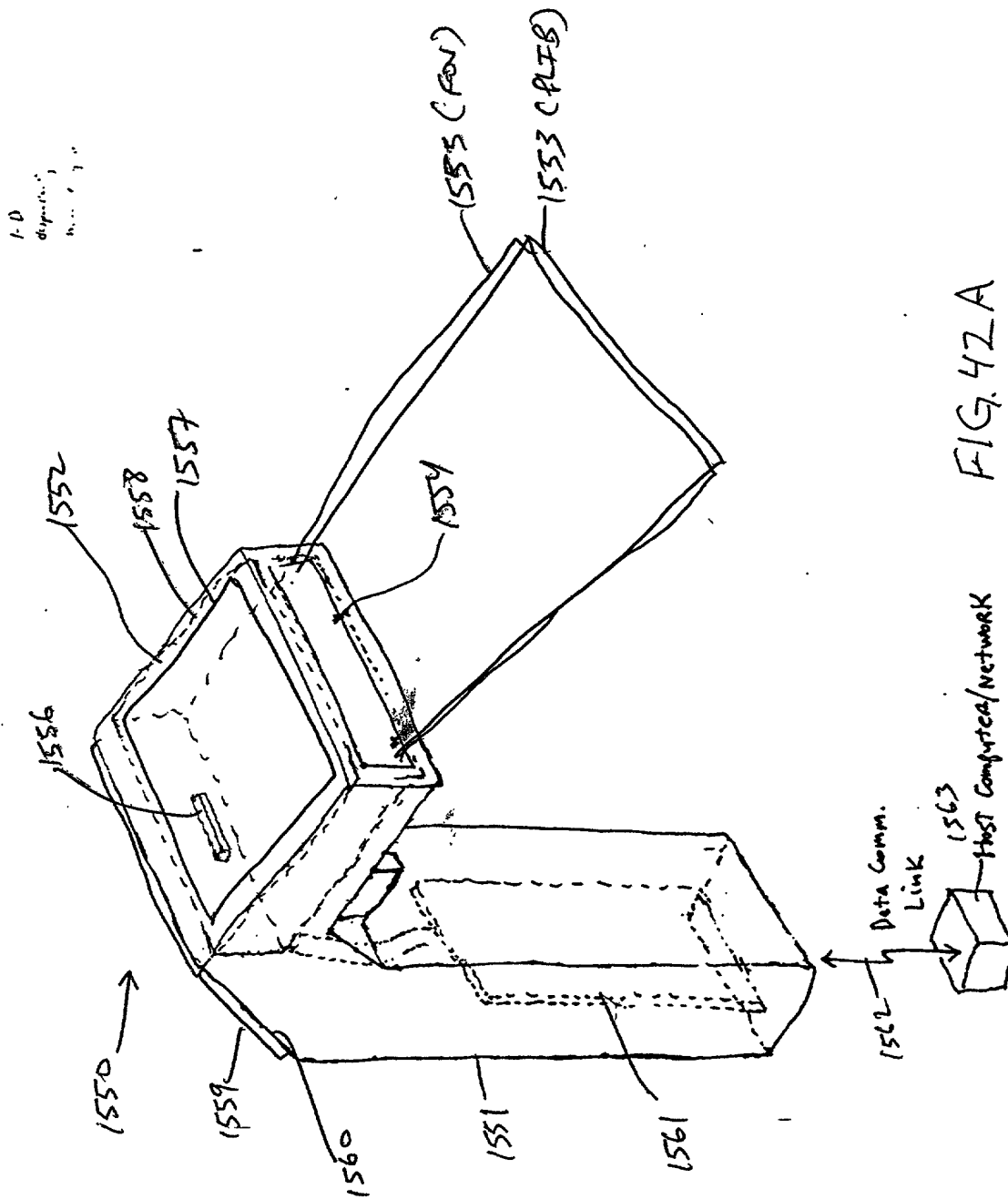


FIG. 42A

289/385

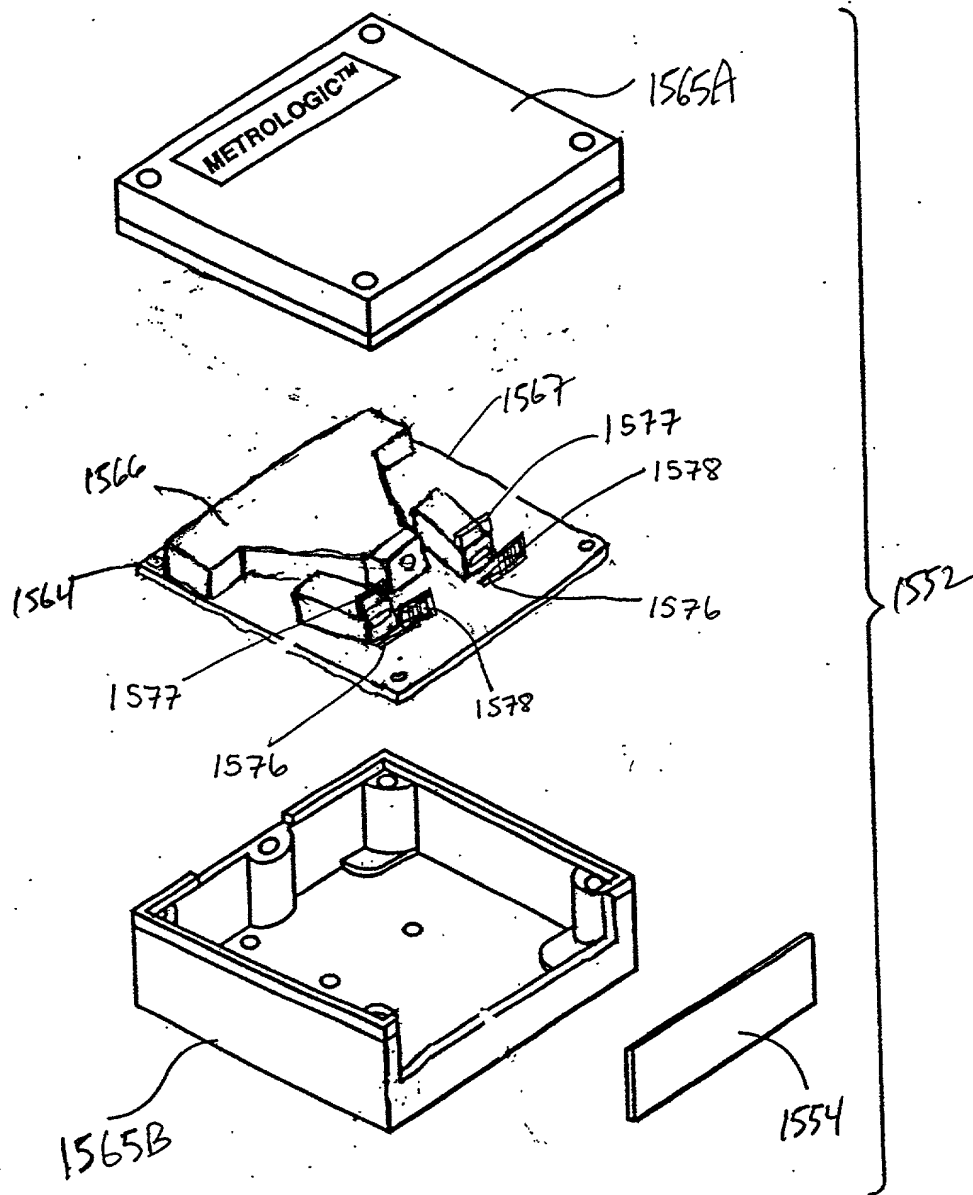


FIG. 42B

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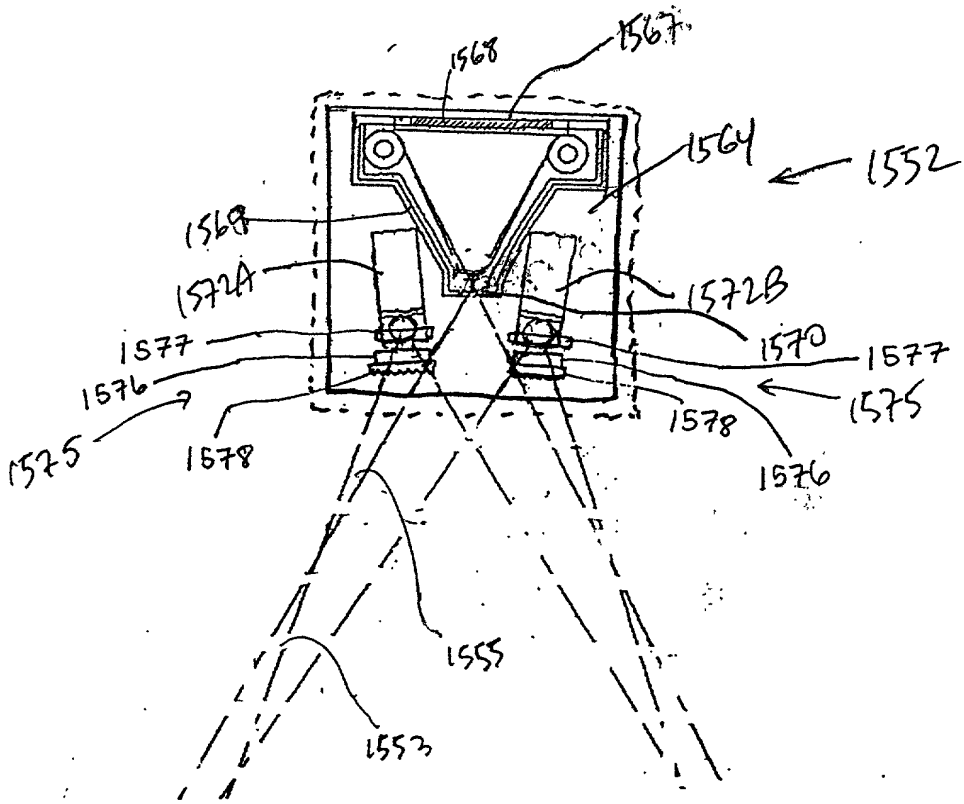


FIG. 42C

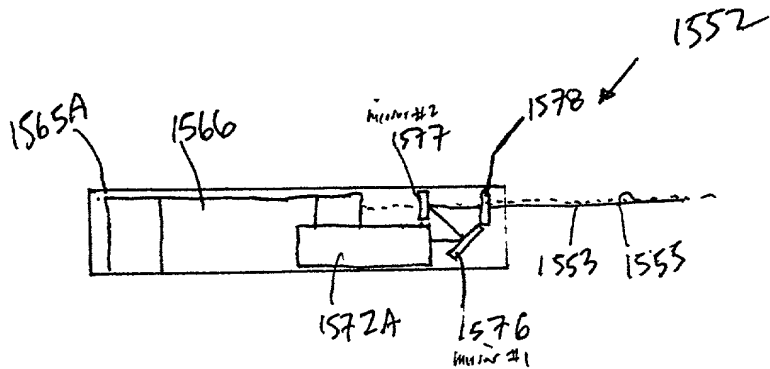


FIG. 42D

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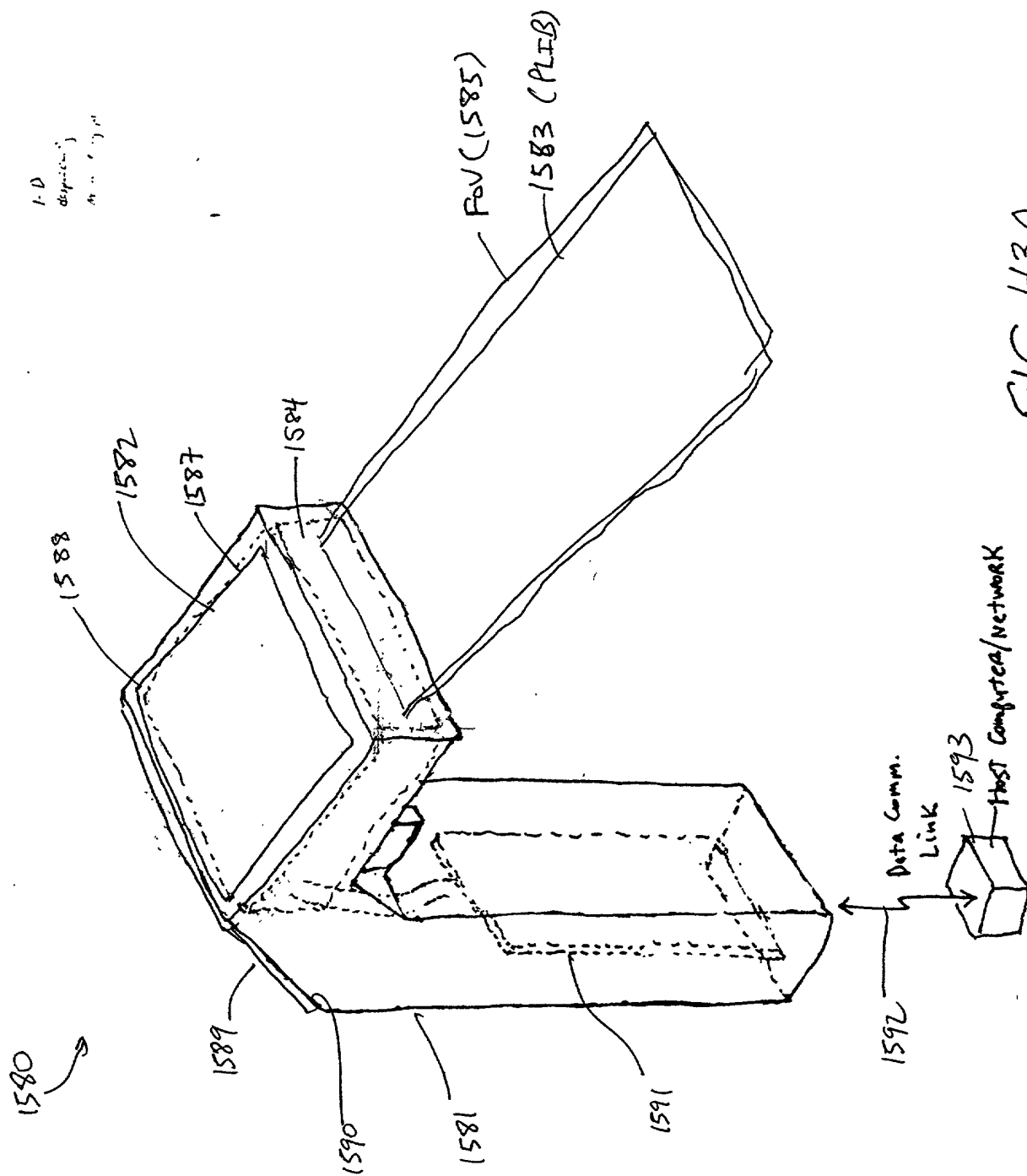


FIG. 43A

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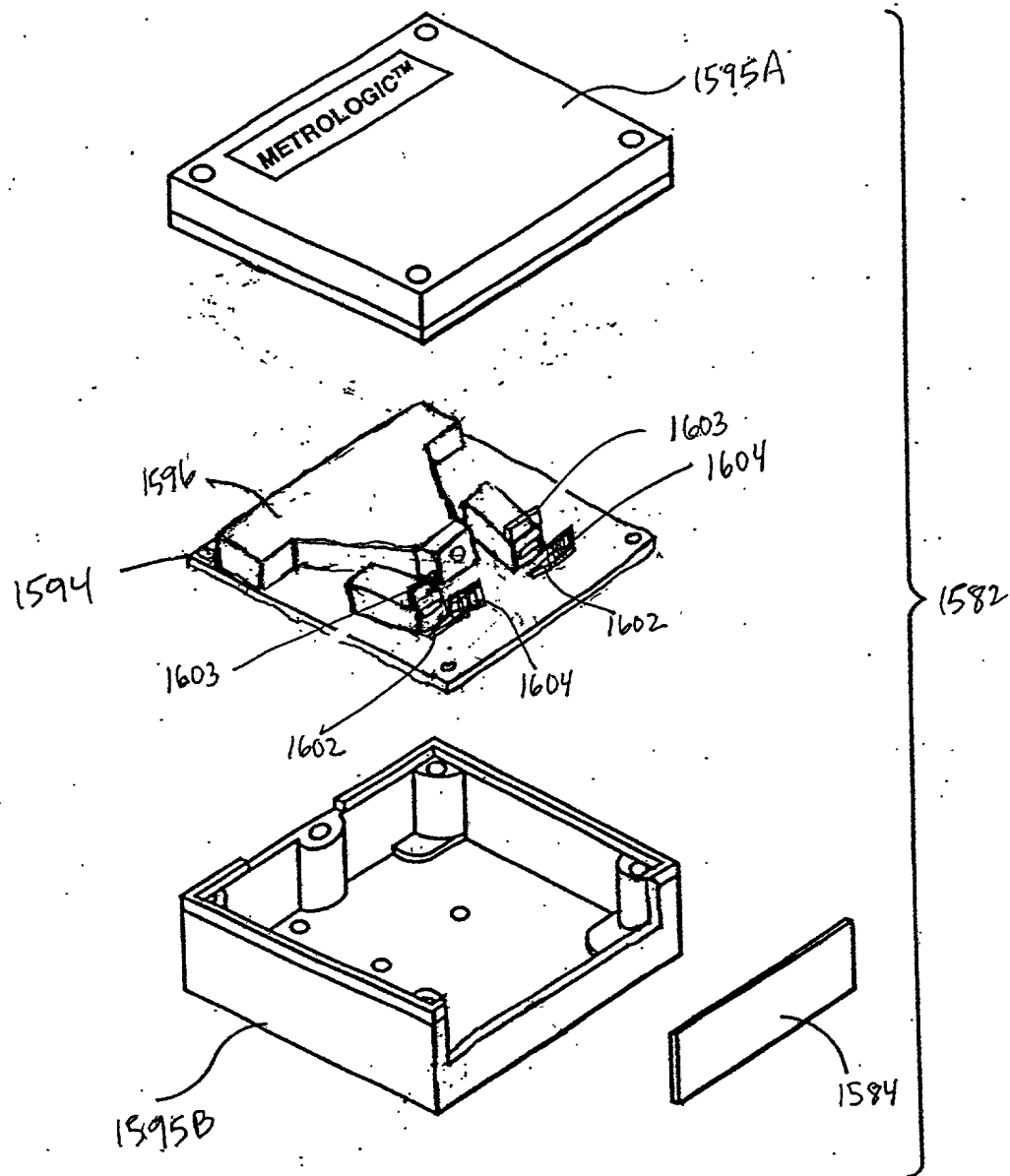


FIG. 43B

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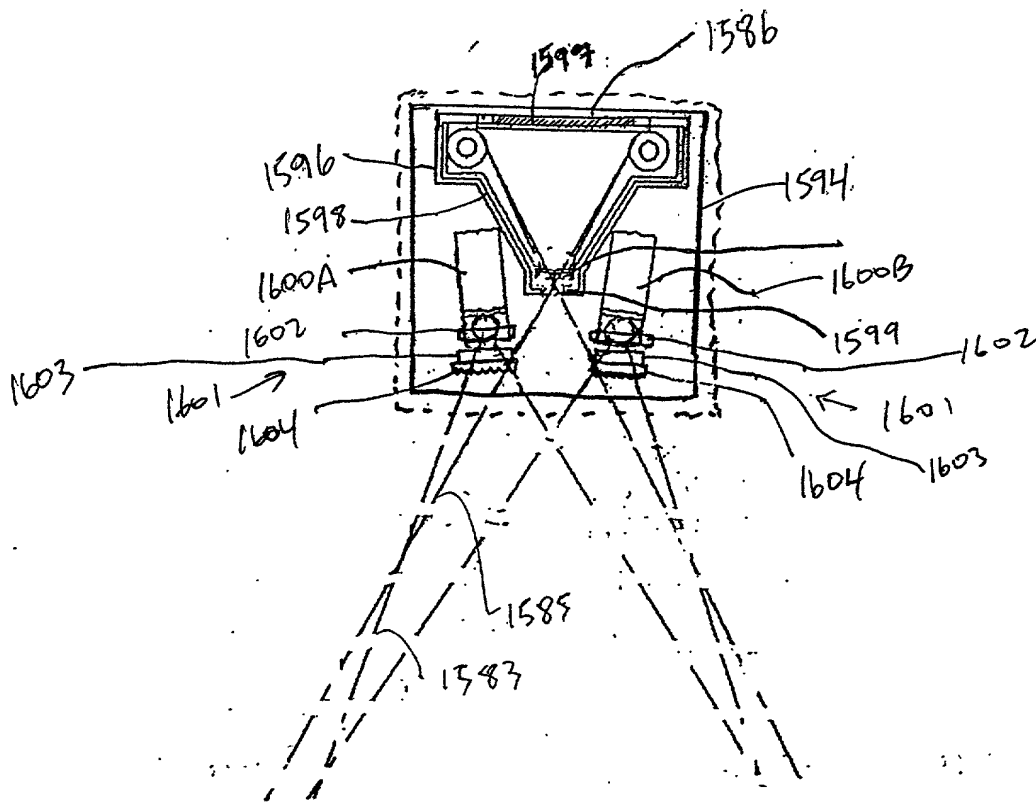


FIG. 43C

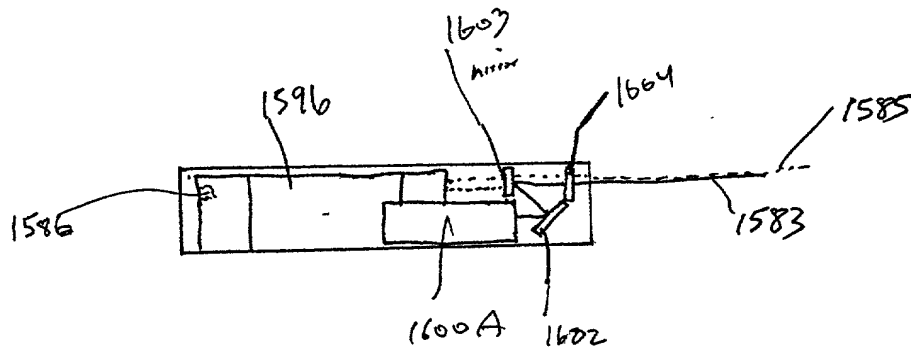
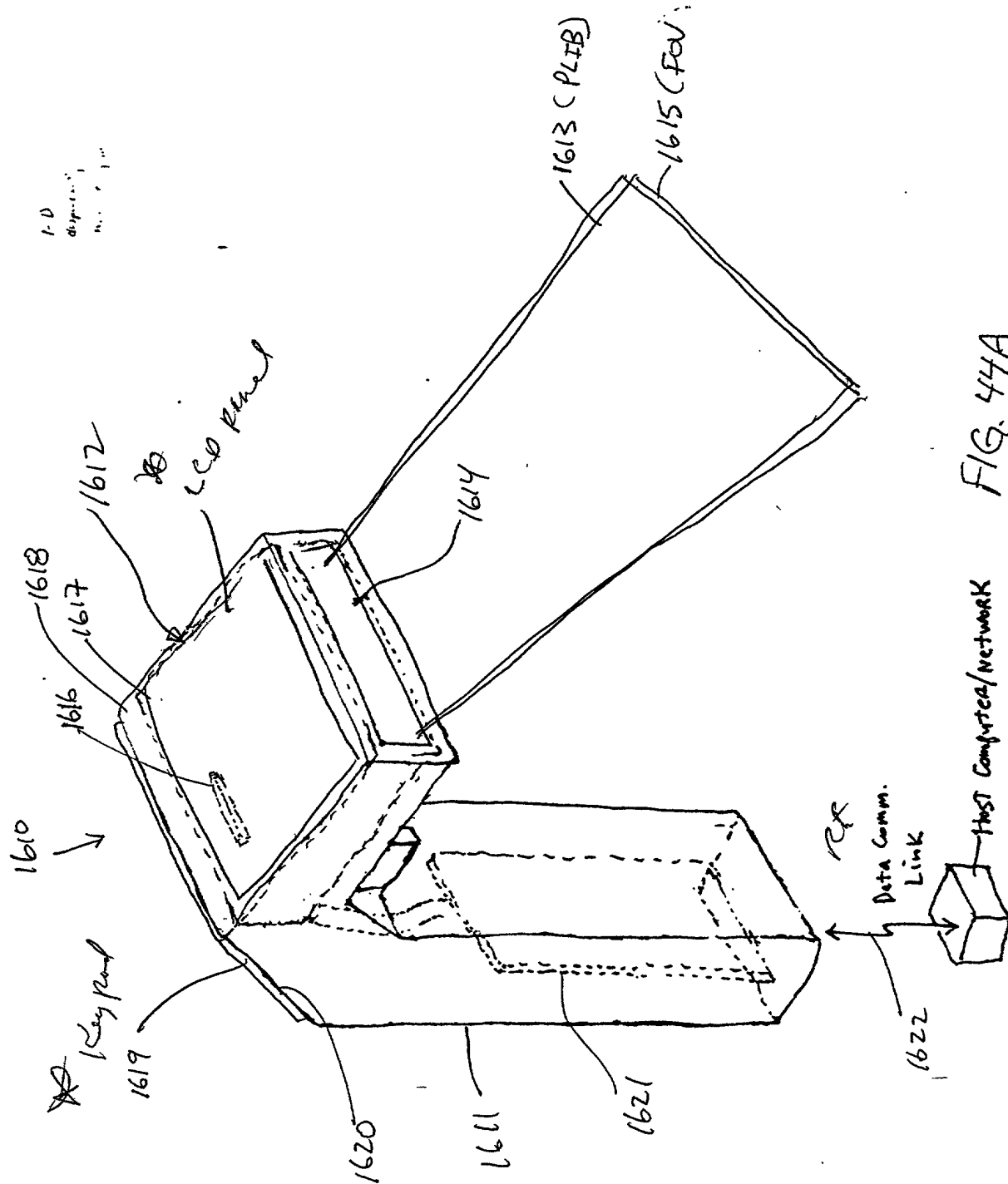


FIG. 43D



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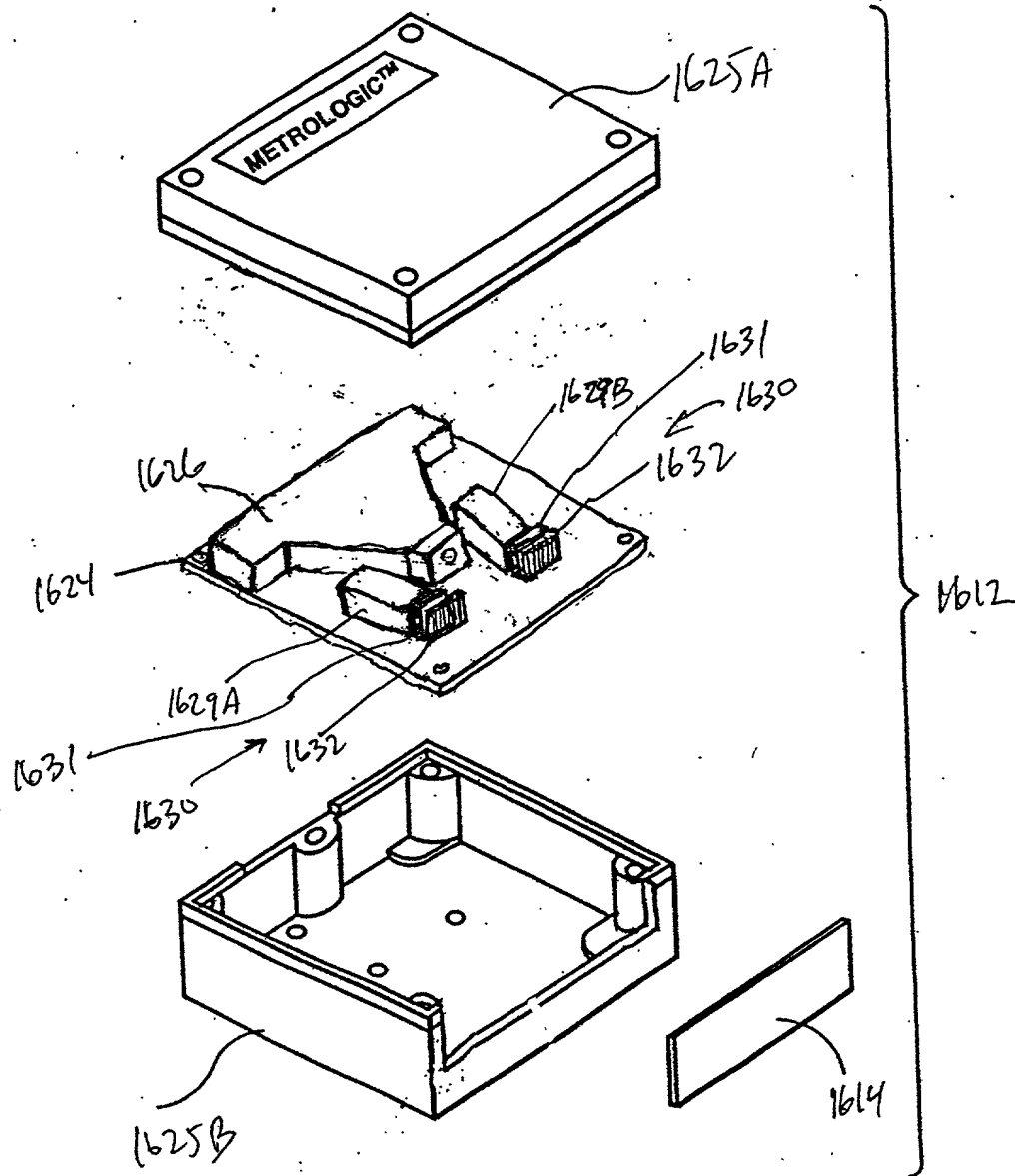


FIG. 44B

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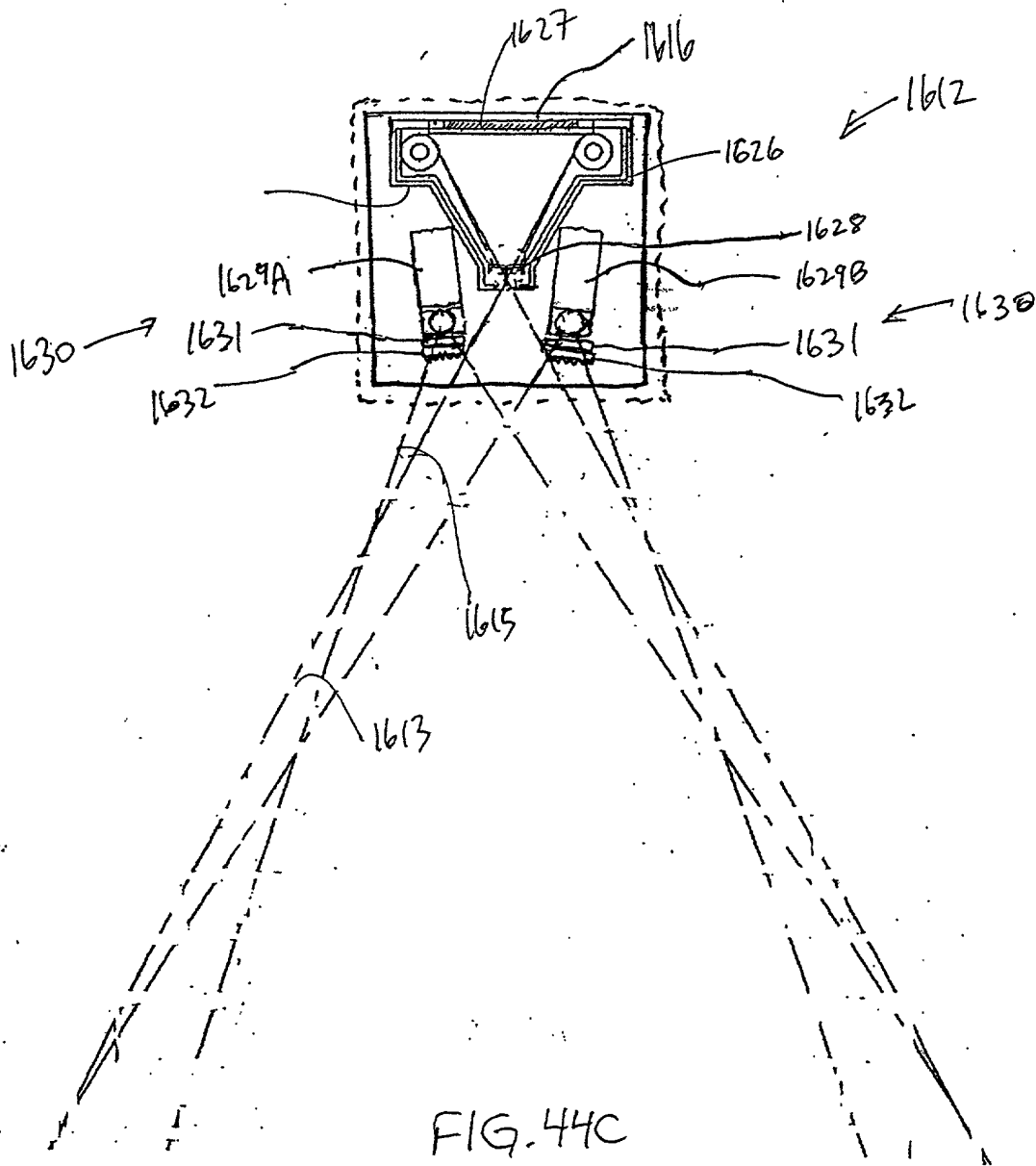


FIG. 44C

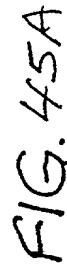


FIG. 45A

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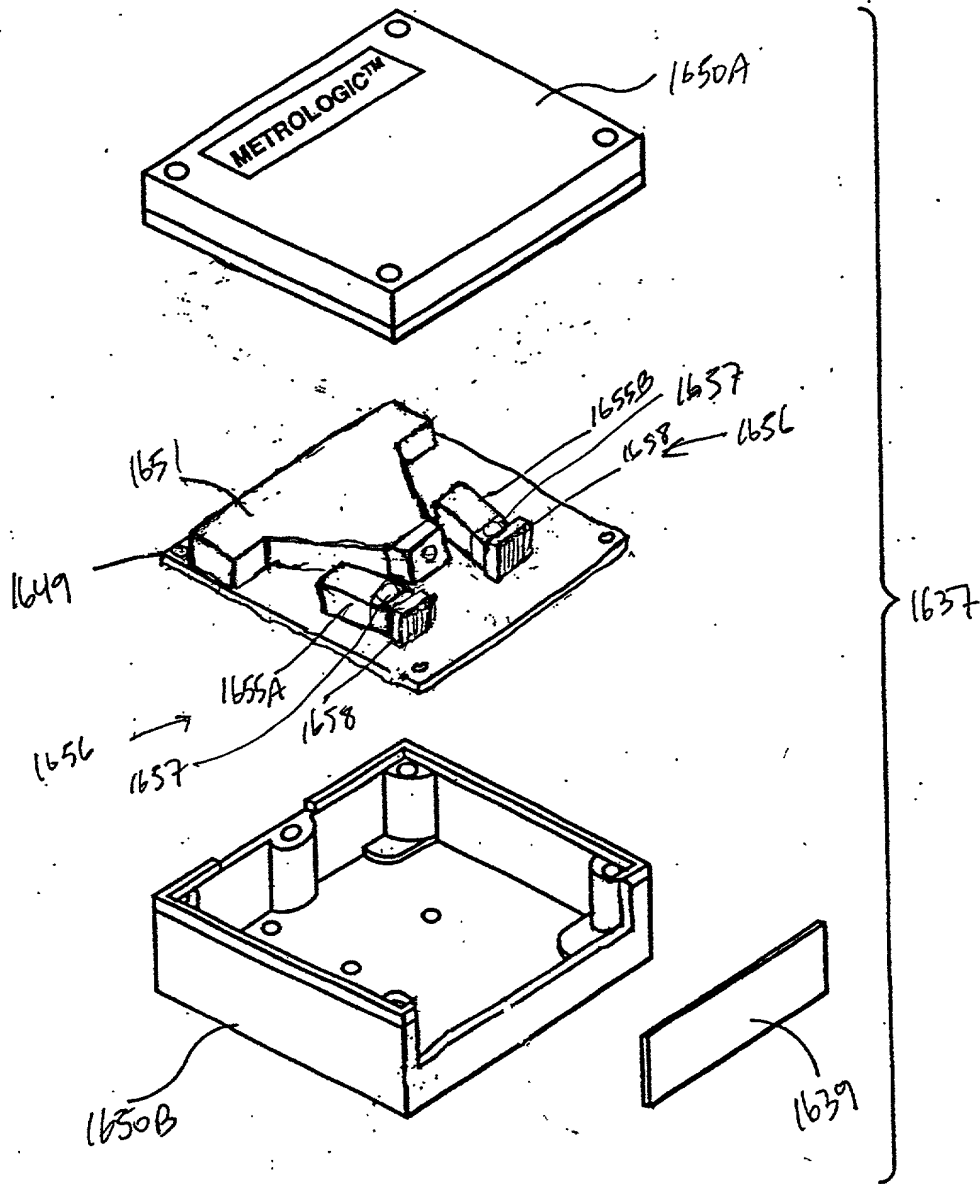


FIG. 45B

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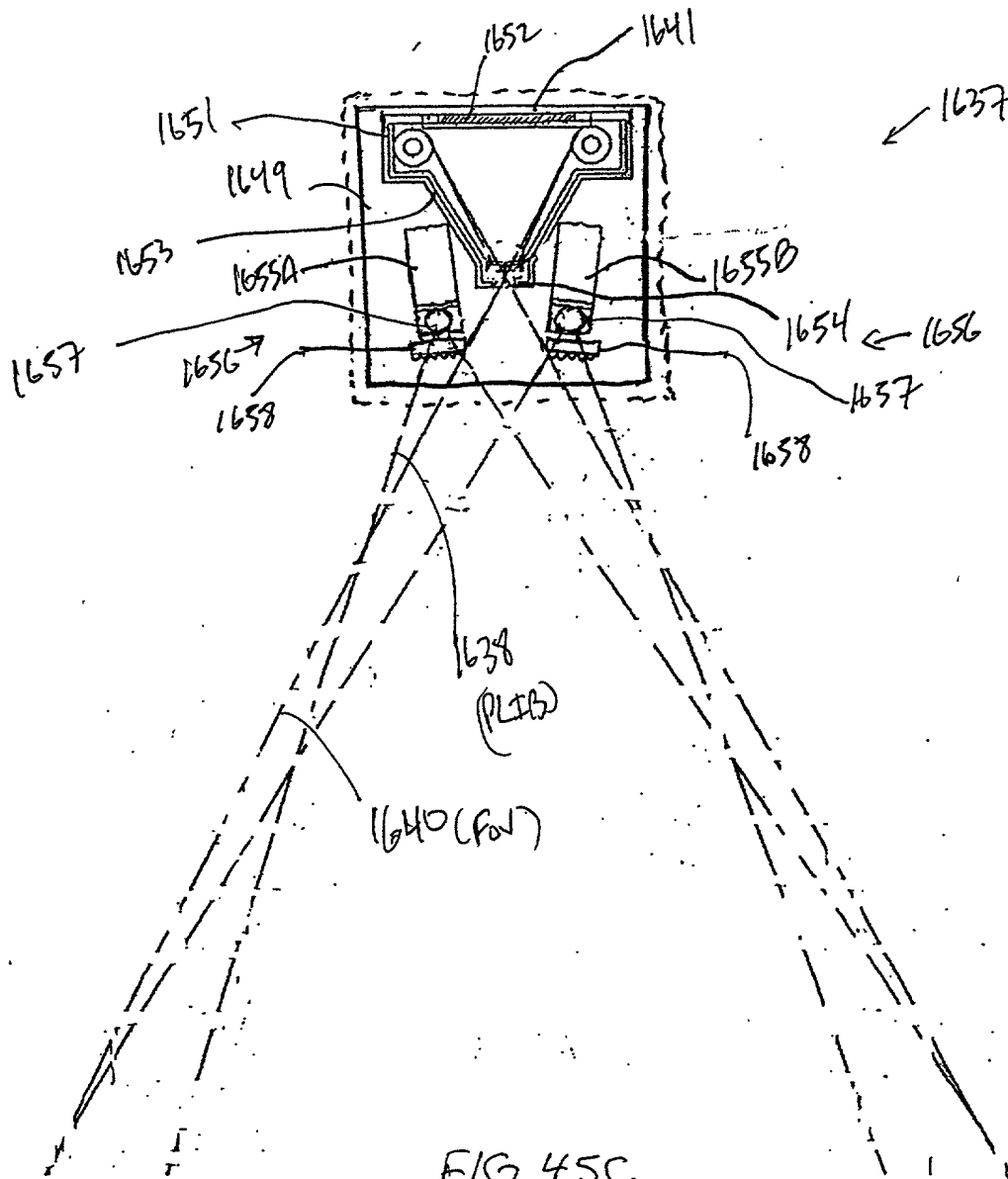


FIG. 45C

08900585 43404

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1-D
display
unit

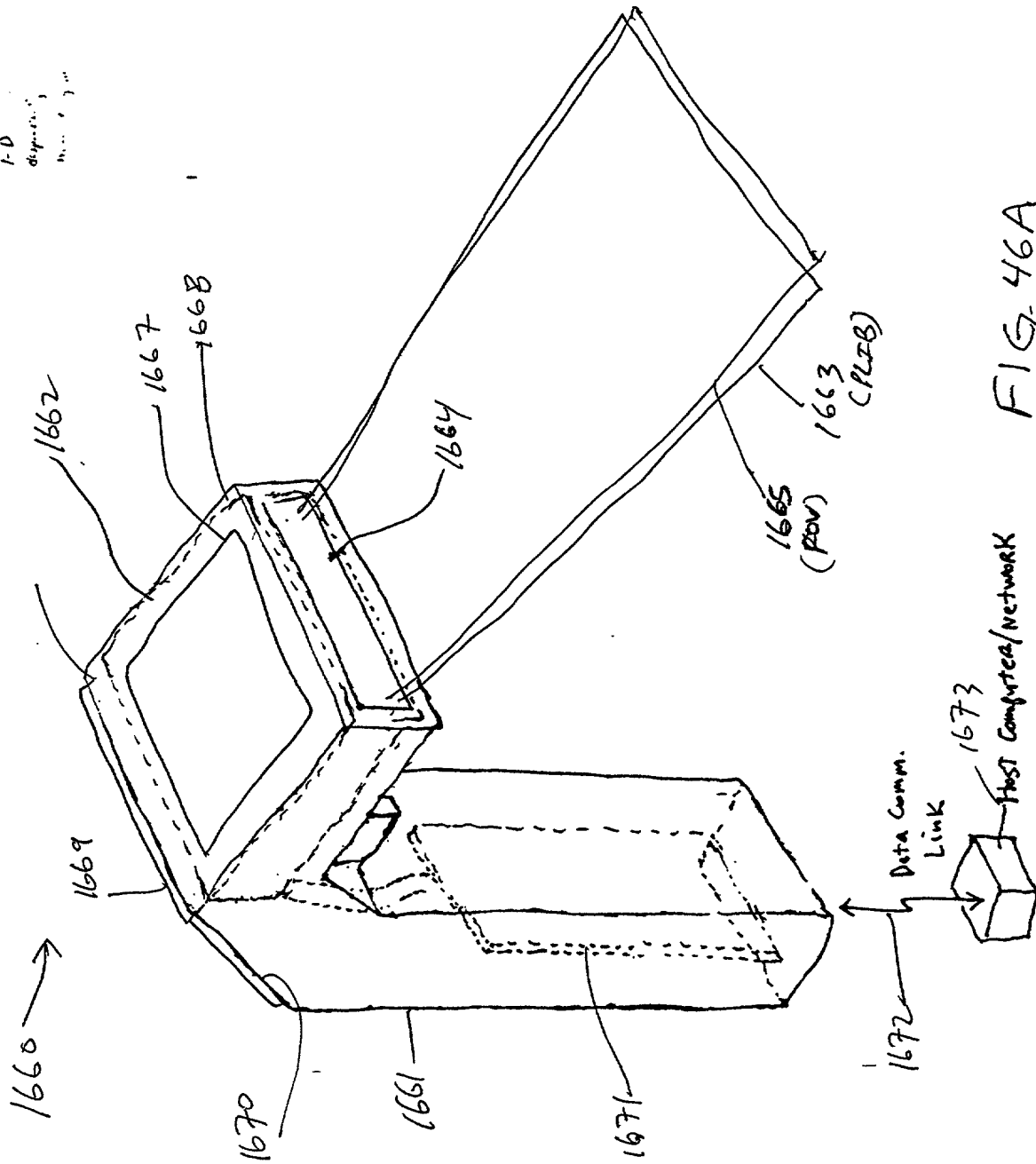


FIG. 46A

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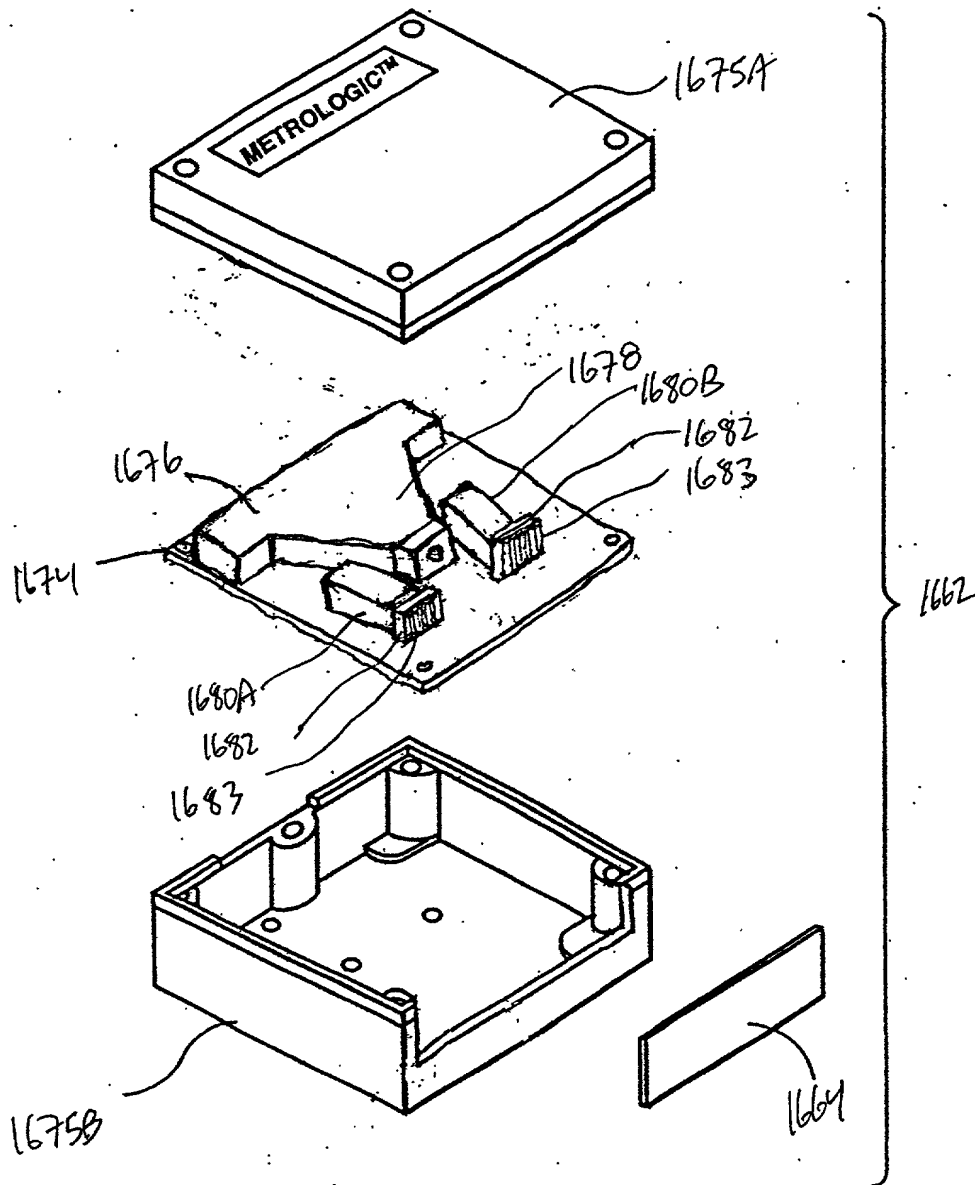
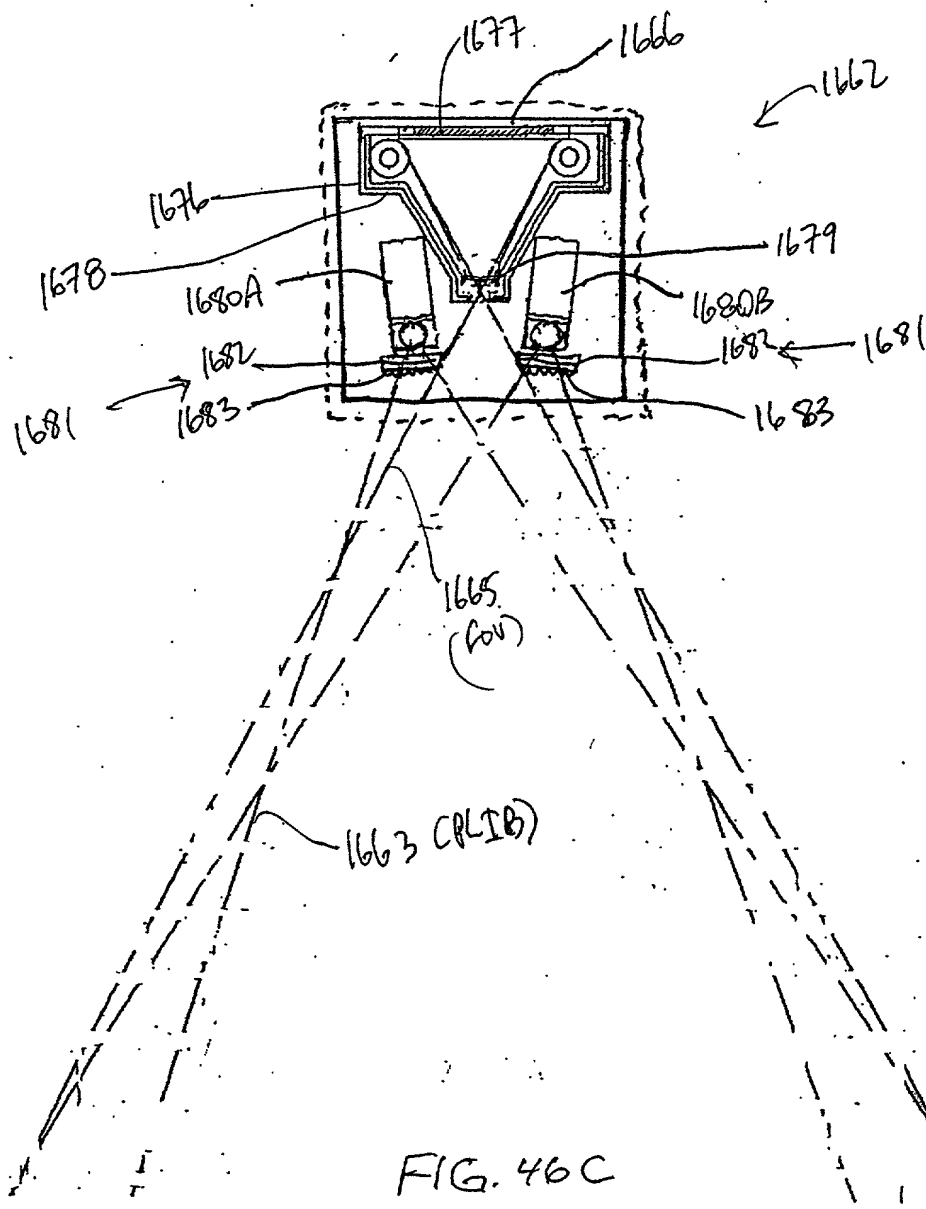


FIG. 46B



1-D
display
unit

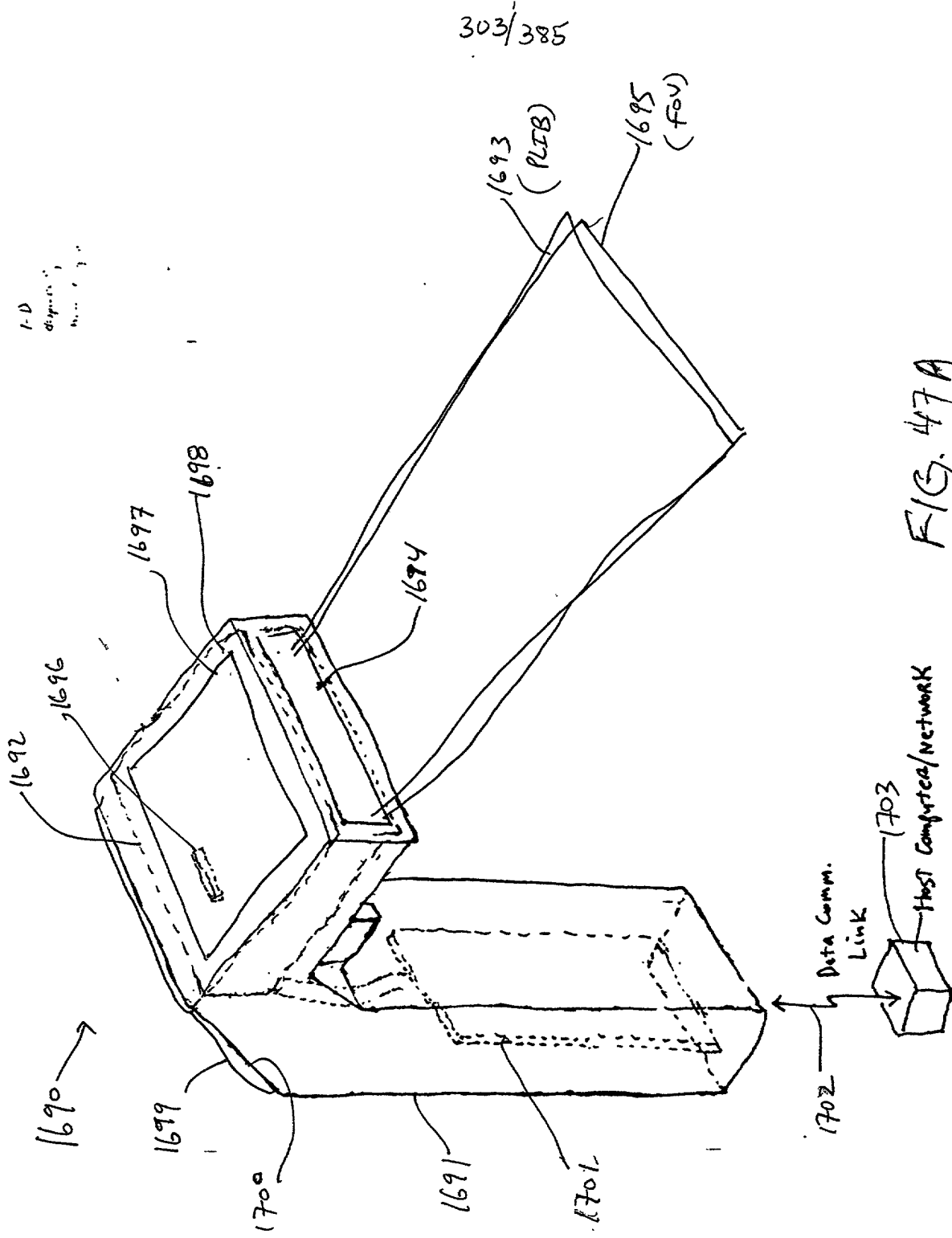


FIG. 47A

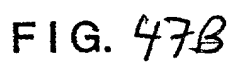
[illegible]

FIG. 47B

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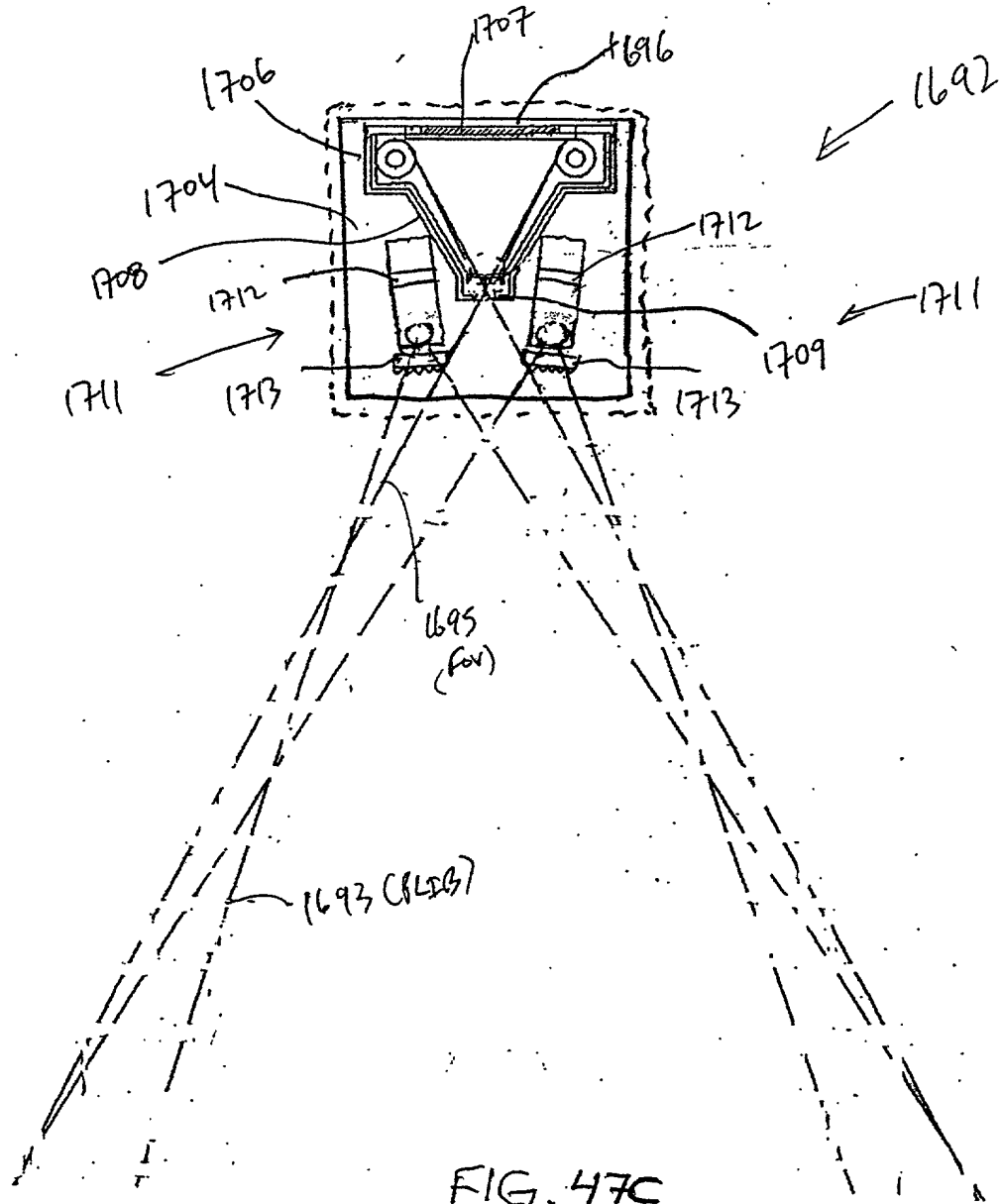


FIG. 47C

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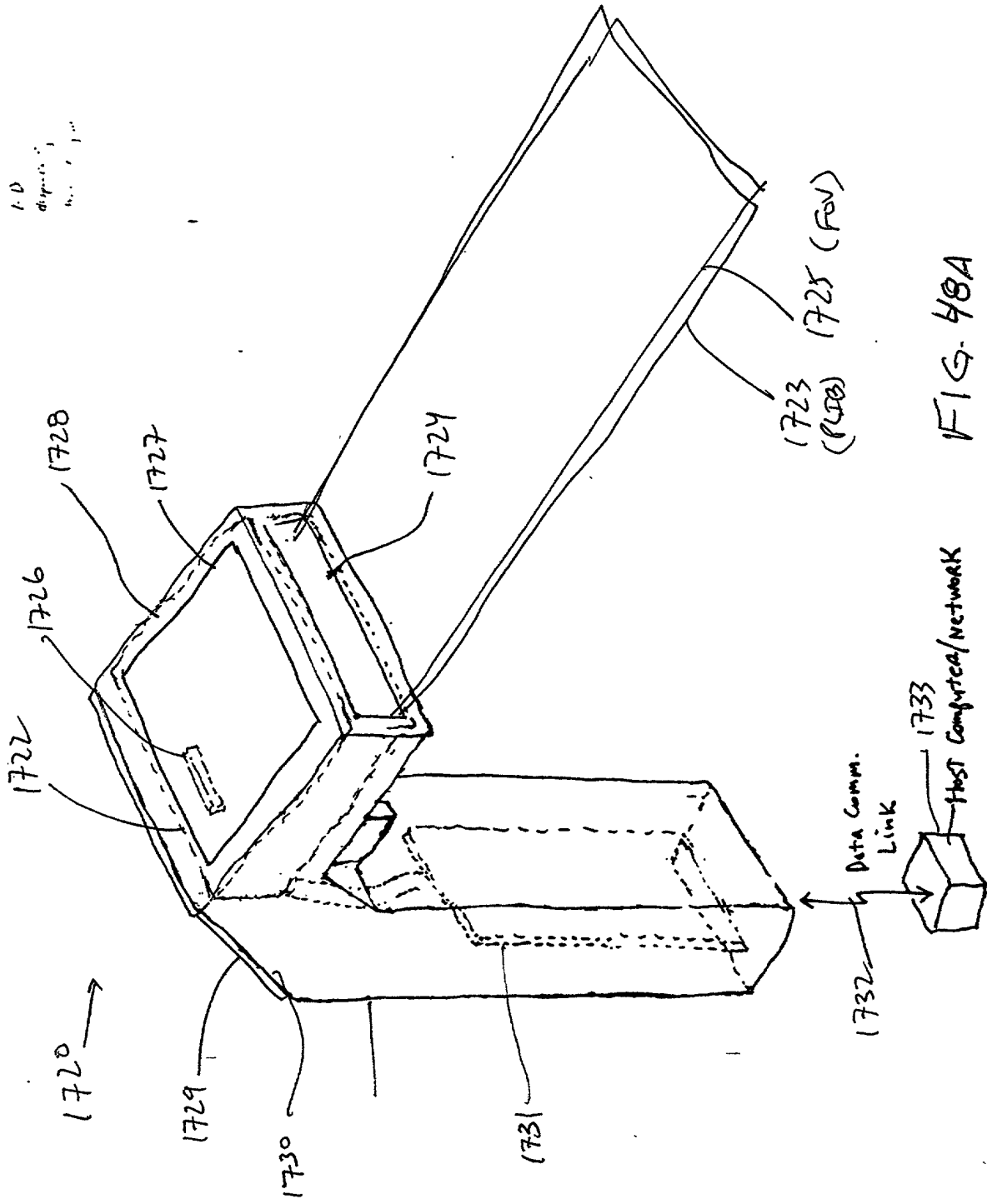


FIG. 48A

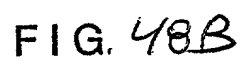
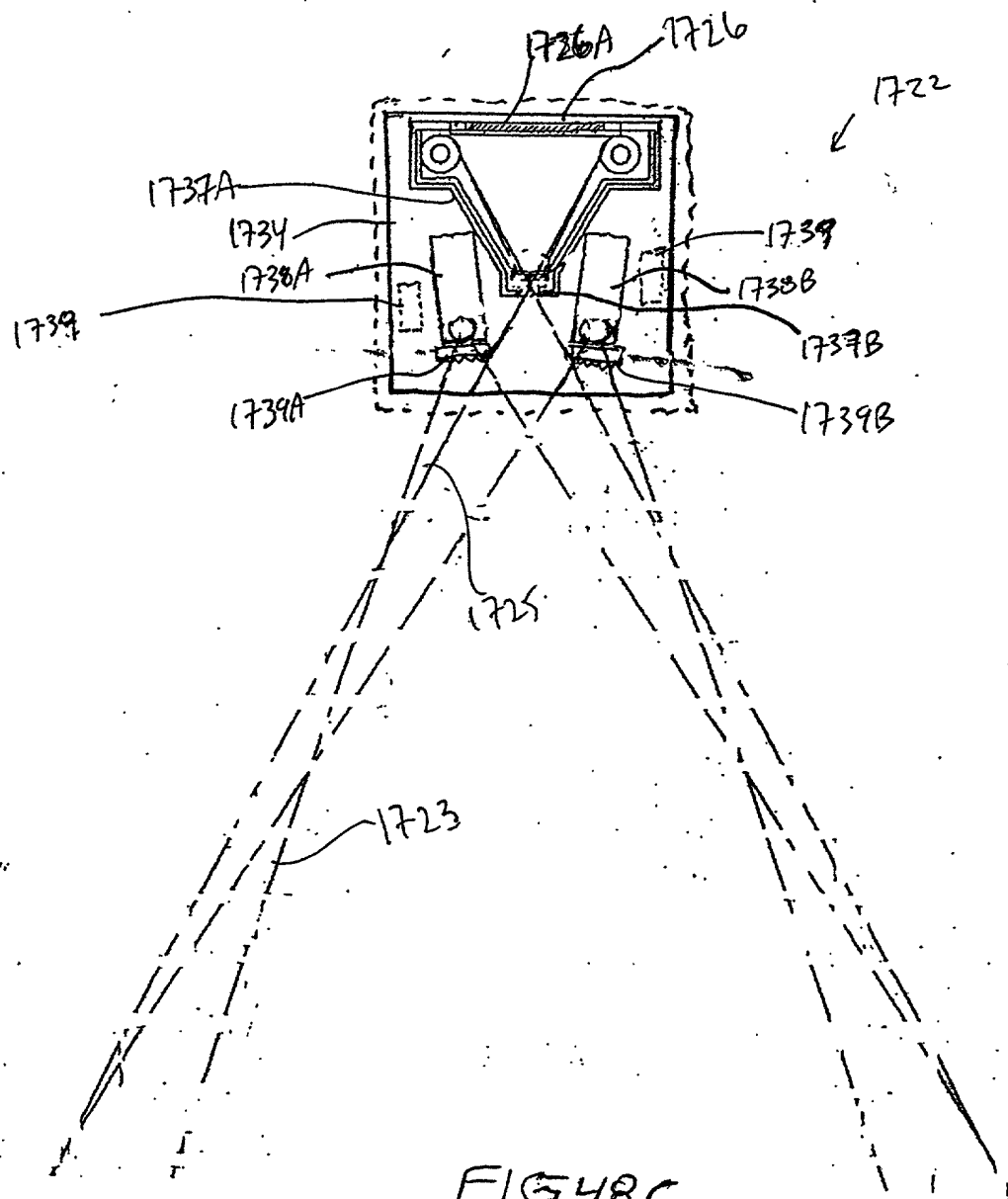
[illegible]

FIG. 48B

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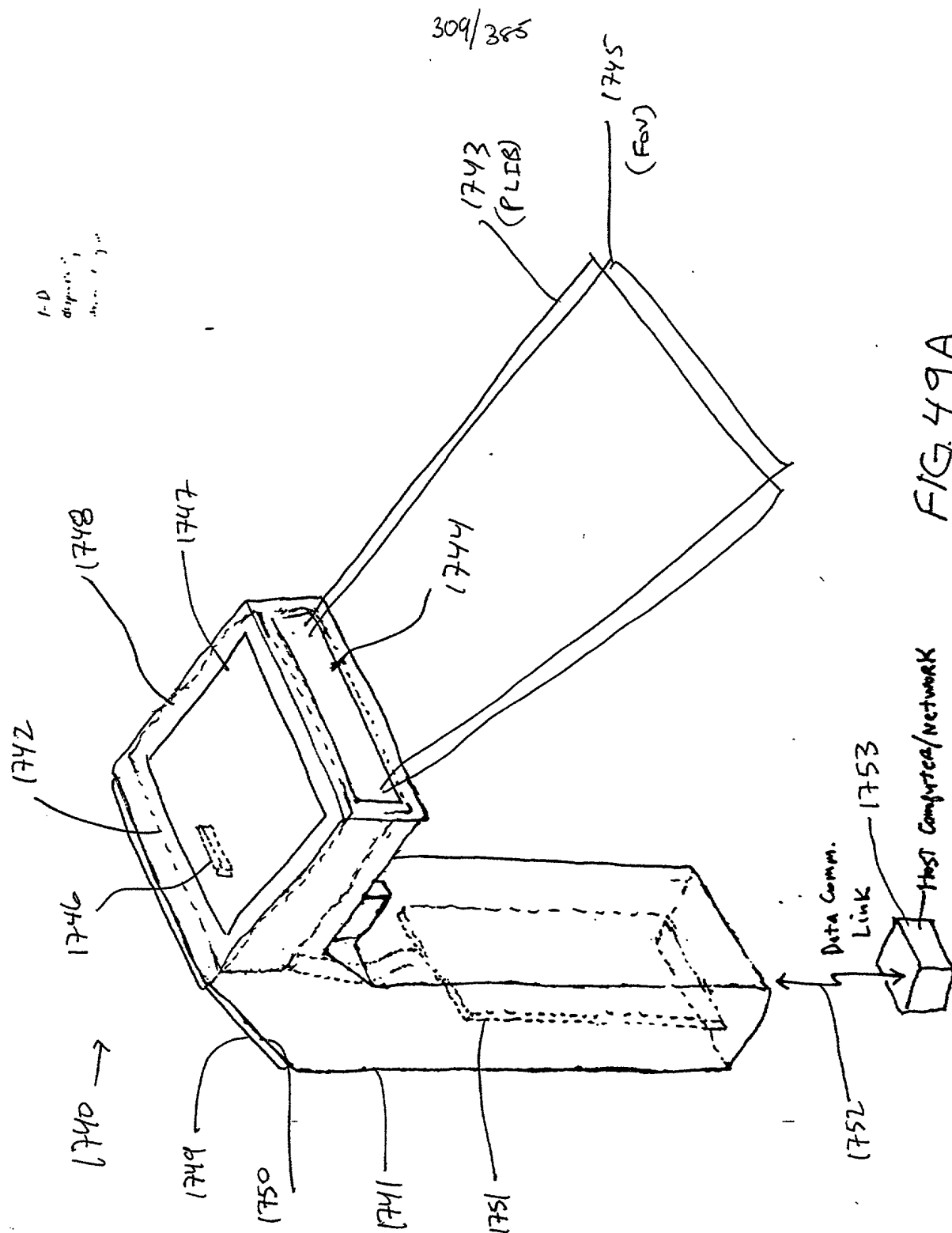


FIG. 49A

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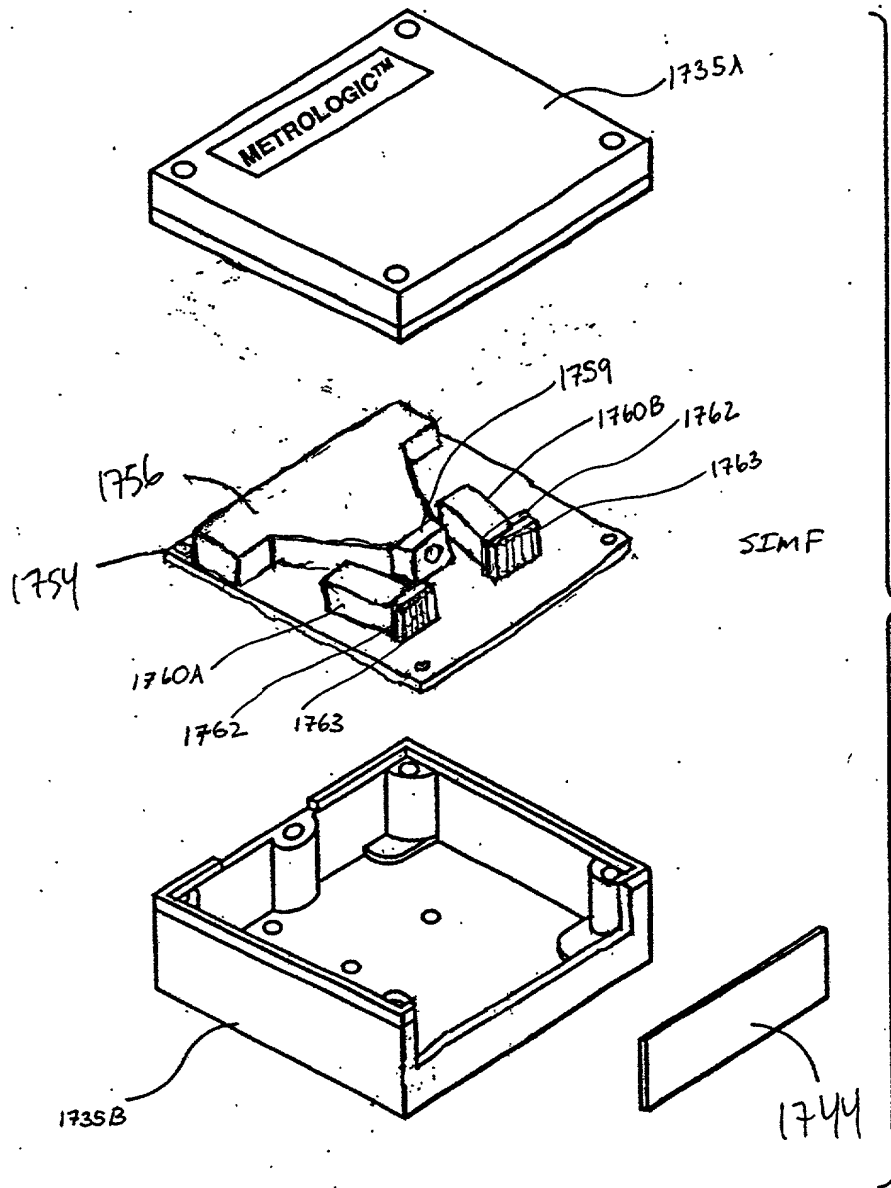


FIG. 49B

(31/385)

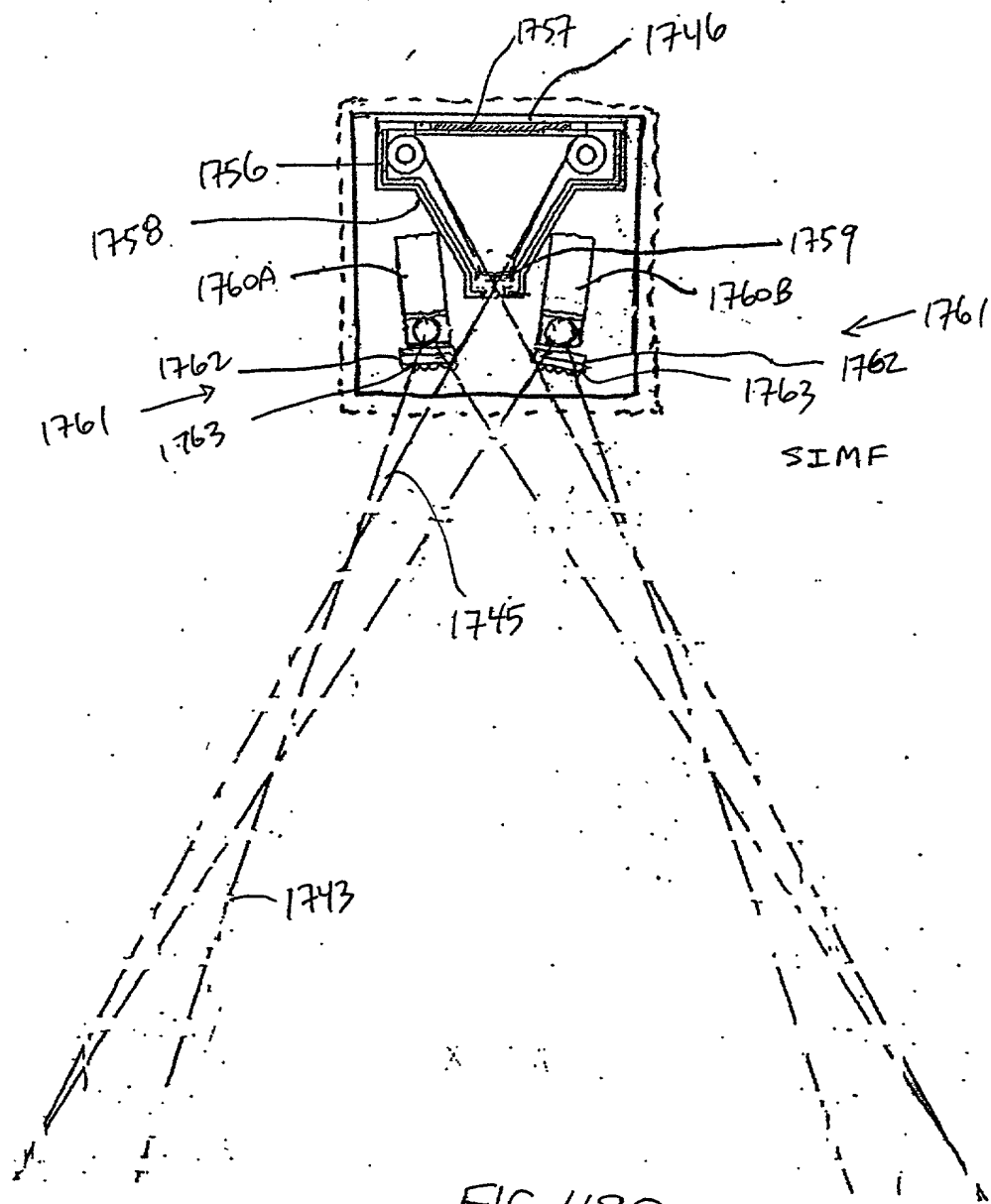


FIG. 49C

1-D
display;
... 3"

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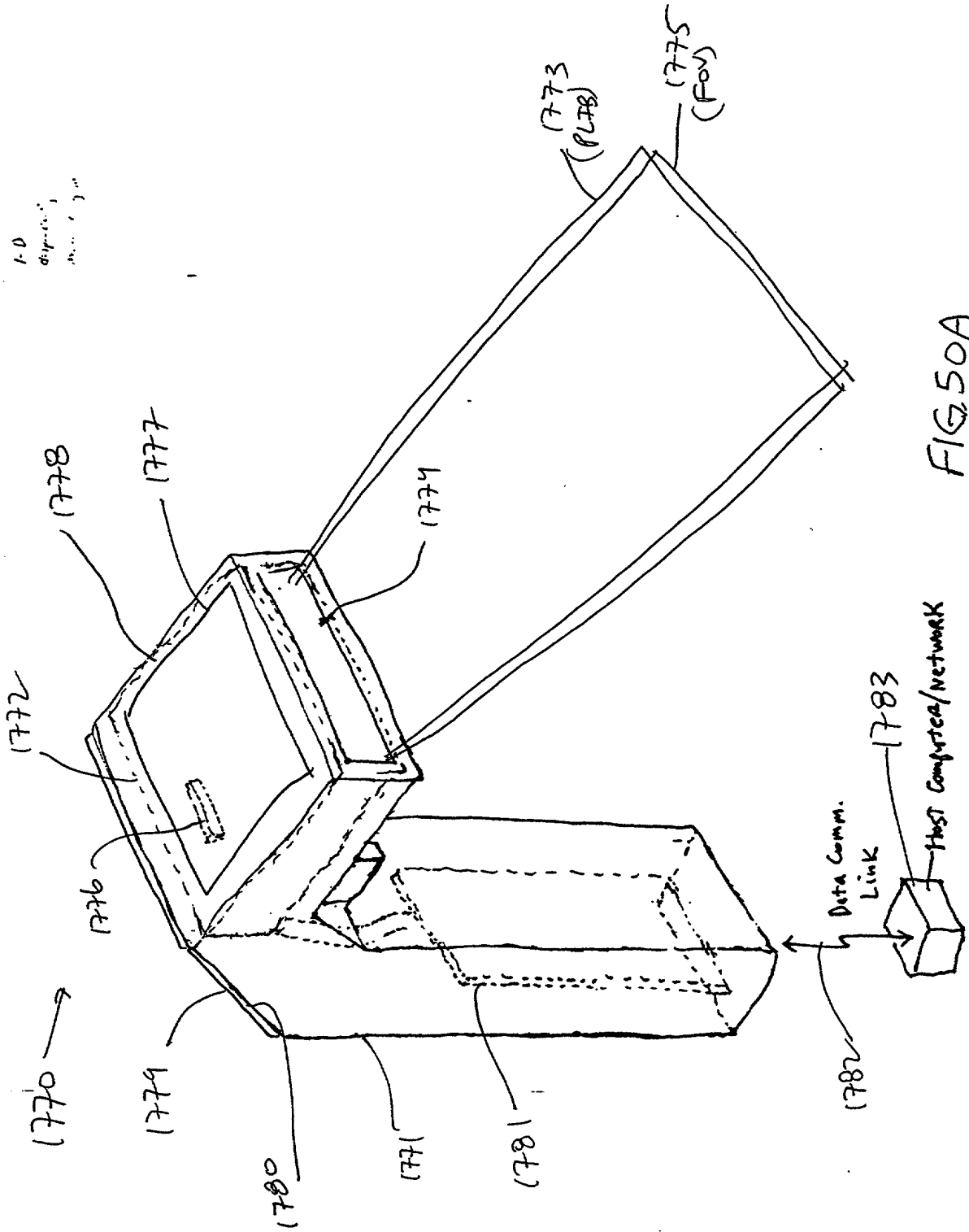


FIG. 50A

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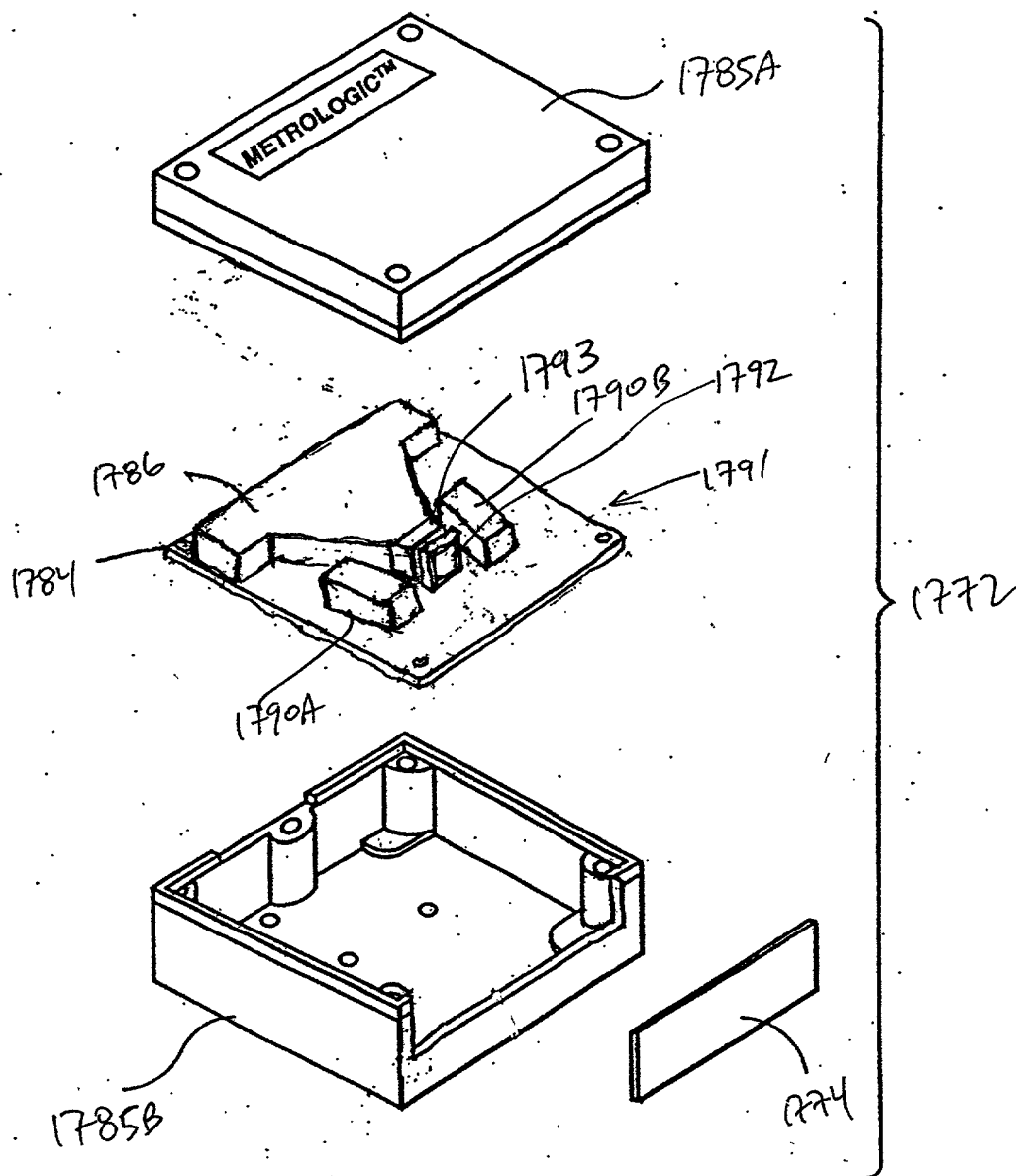
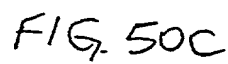


FIG. 50B

Variable	Mean	SD	Min	Max
Age	34.5	10.2	21	55
Gender	0.5	0.5	0	1
Marital status	0.6	0.5	0	1
Education	12.5	1.5	9	16
Income	1500	500	500	3000
Health status	0.8	0.2	0	1
Smoking status	0.3	0.5	0	1
Alcohol consumption	0.2	0.4	0	1
Exercise frequency	0.5	0.5	0	1
Stress level	0.7	0.3	0	1
Sleep quality	0.6	0.4	0	1
Work satisfaction	0.5	0.5	0	1
Life satisfaction	0.6	0.4	0	1
Depression score	0.3	0.5	0	1
Anxiety score	0.2	0.4	0	1
Overall well-being	0.5	0.5	0	1



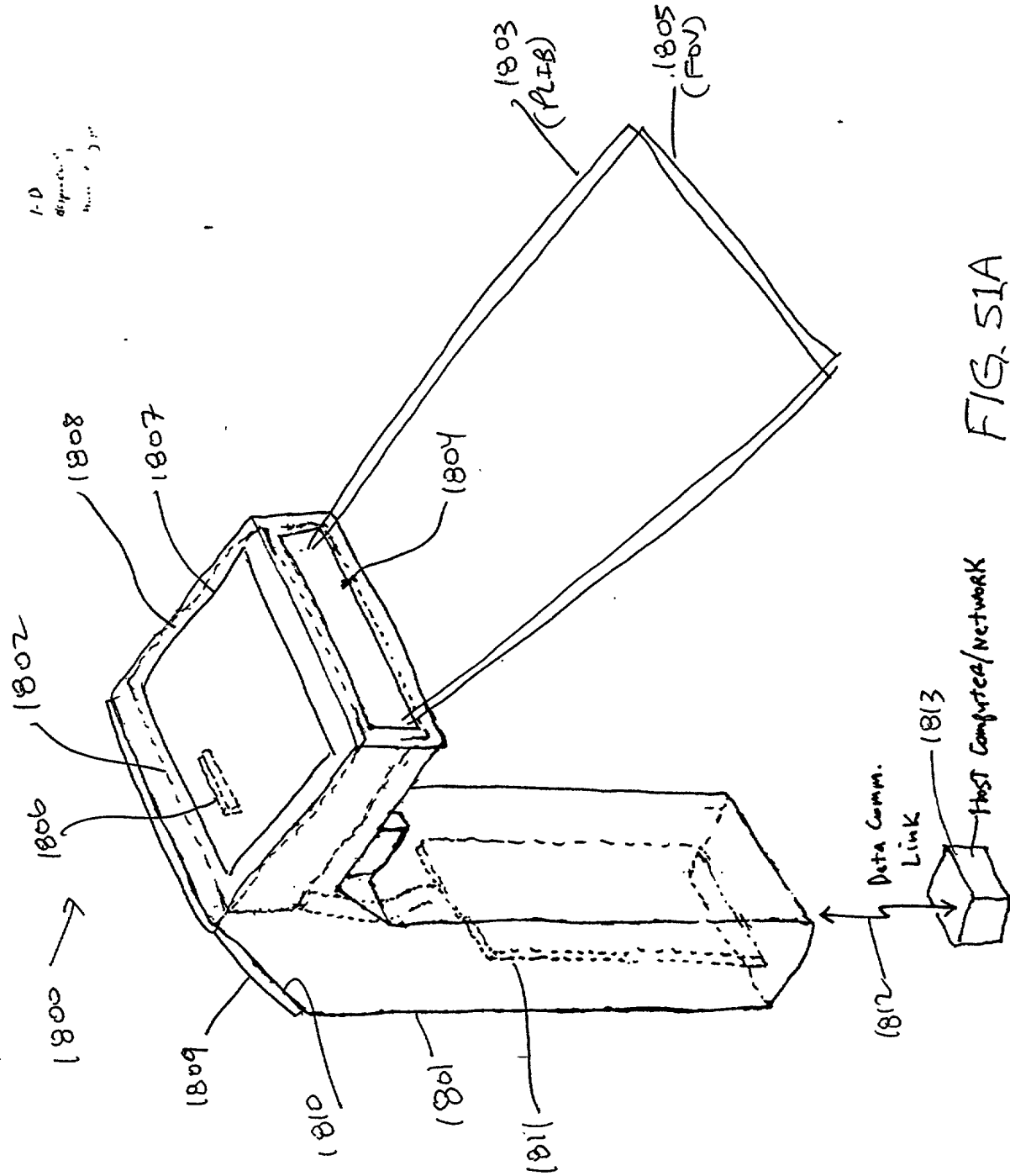


FIG. 51A

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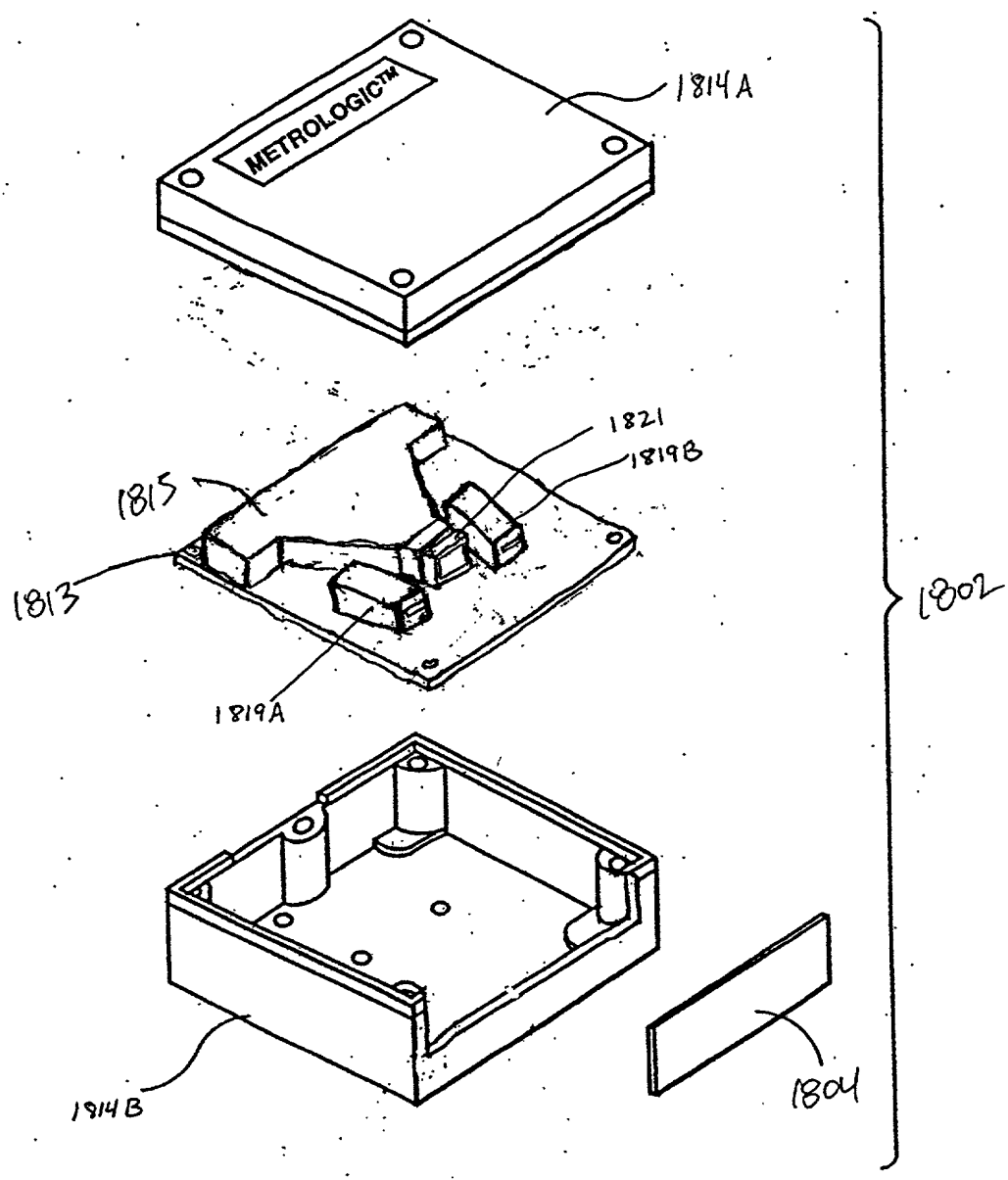


FIG. 51B

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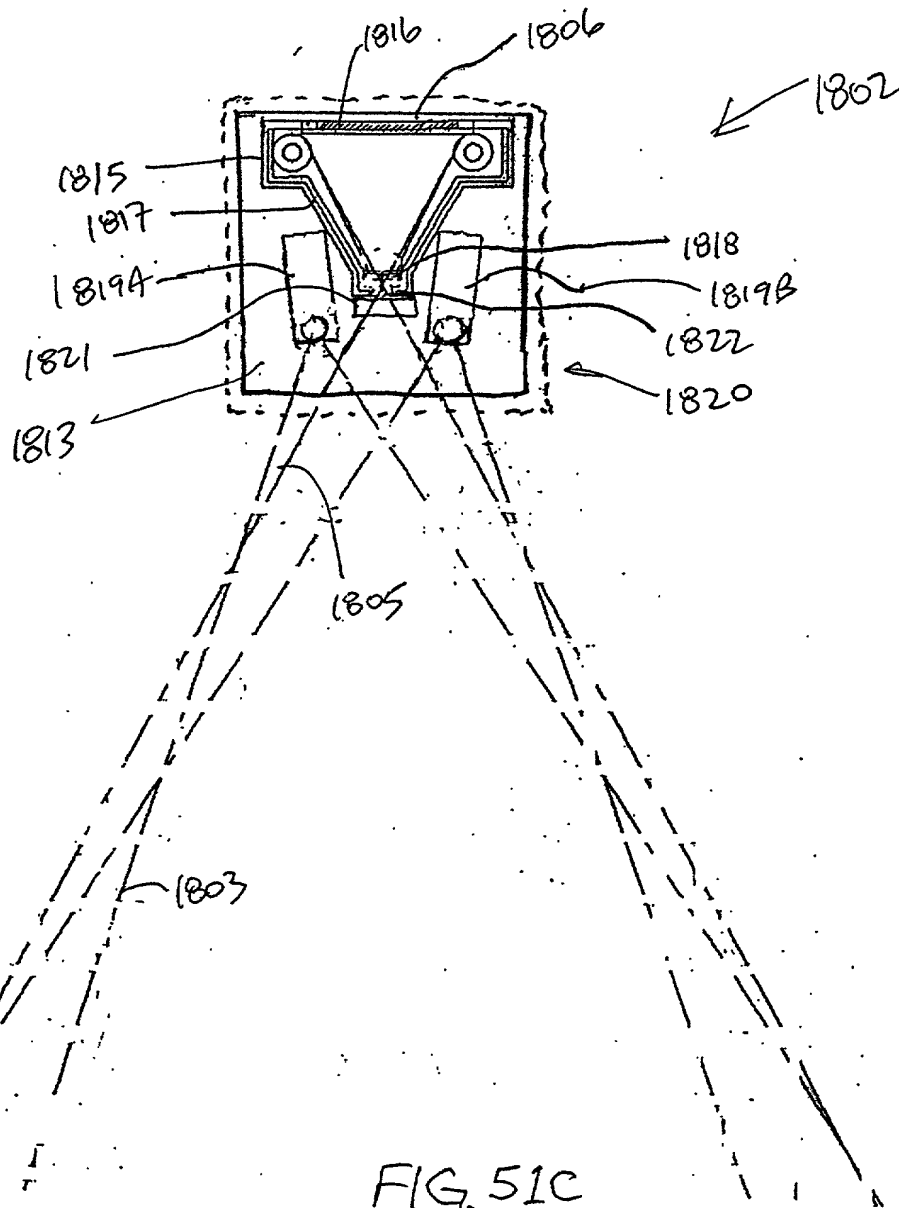
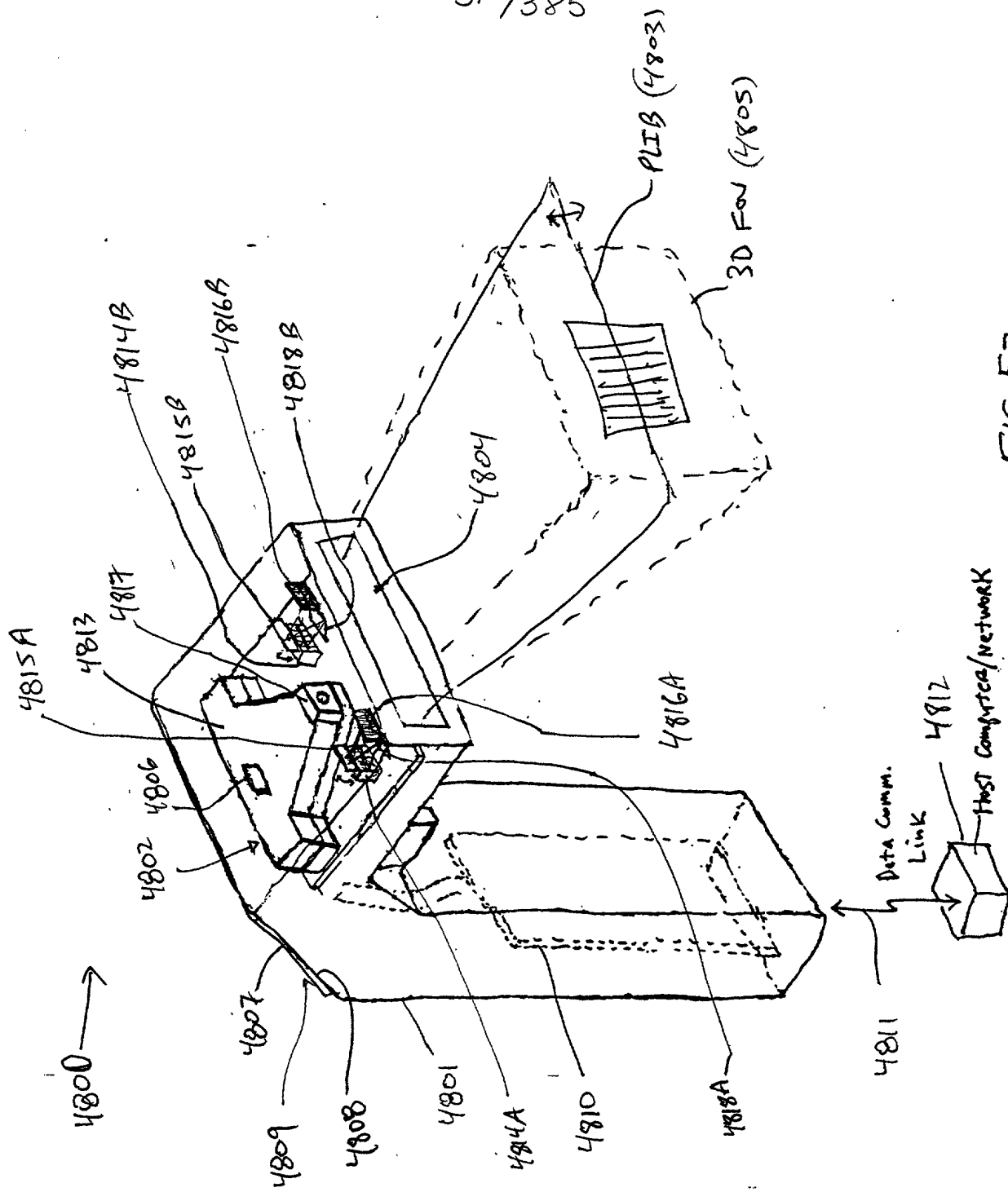


FIG. 51C

00000585-1401
TOTAL 58506660



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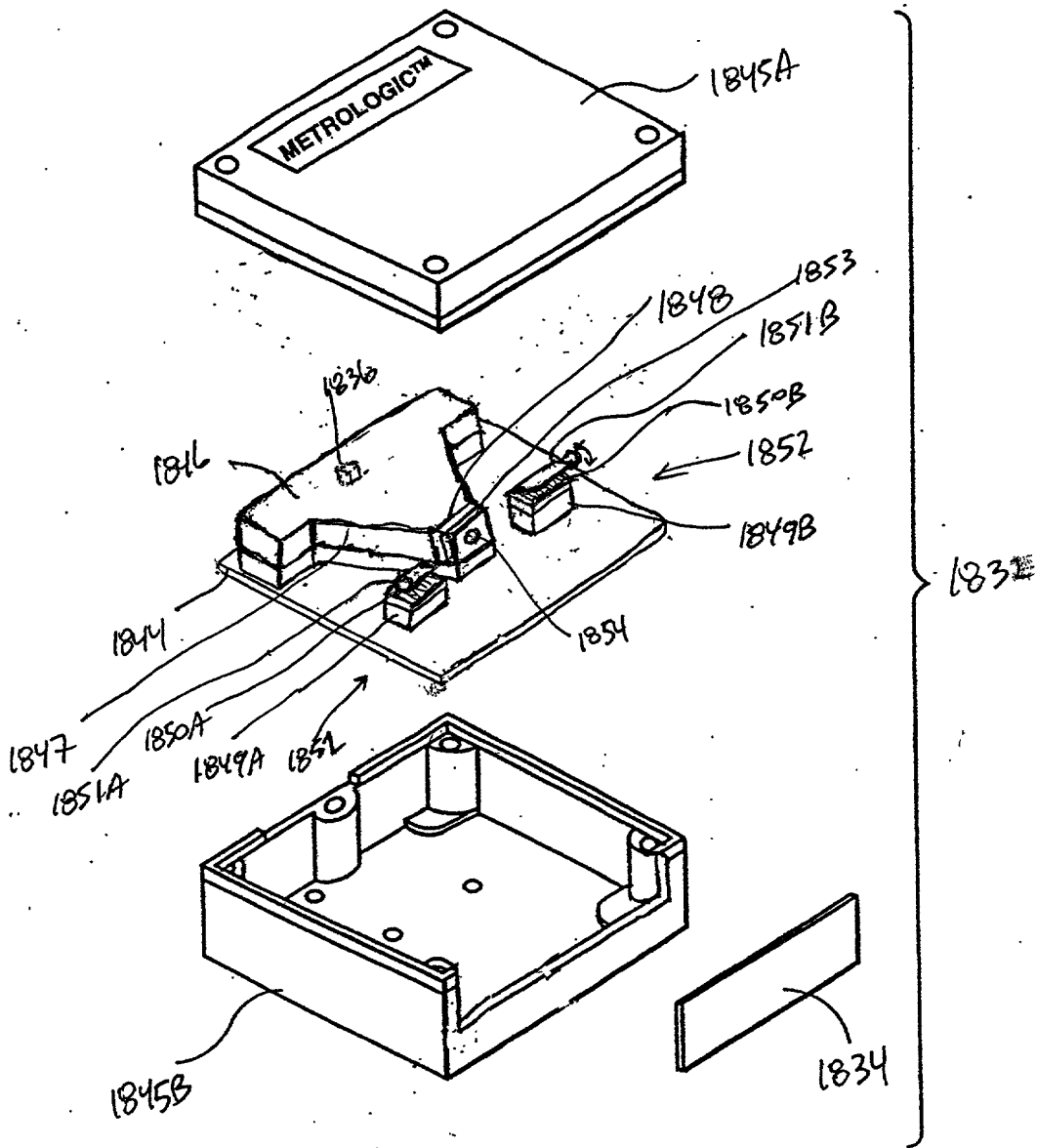


FIG. 52B

Fig. 1I 3A-3B

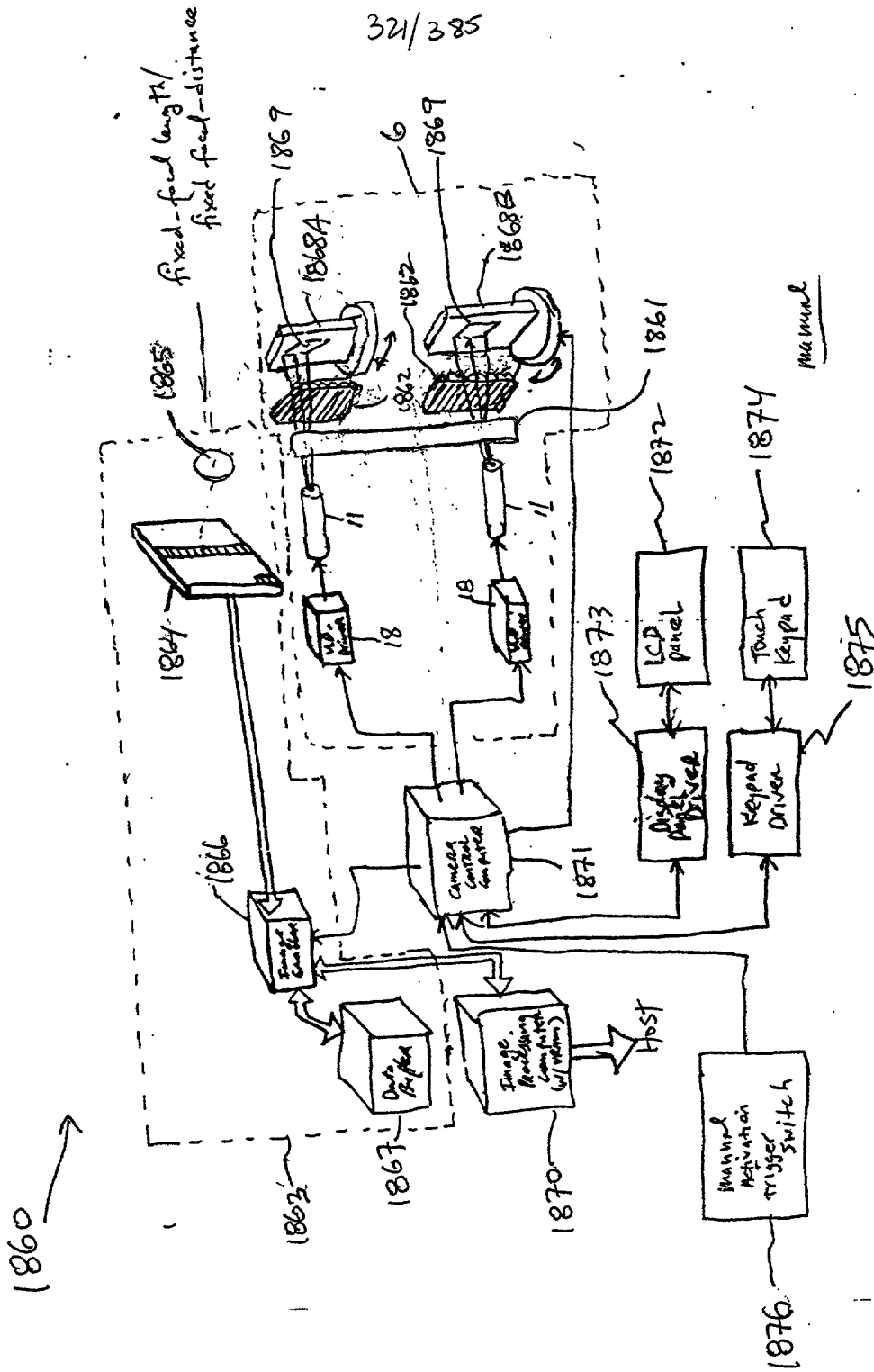
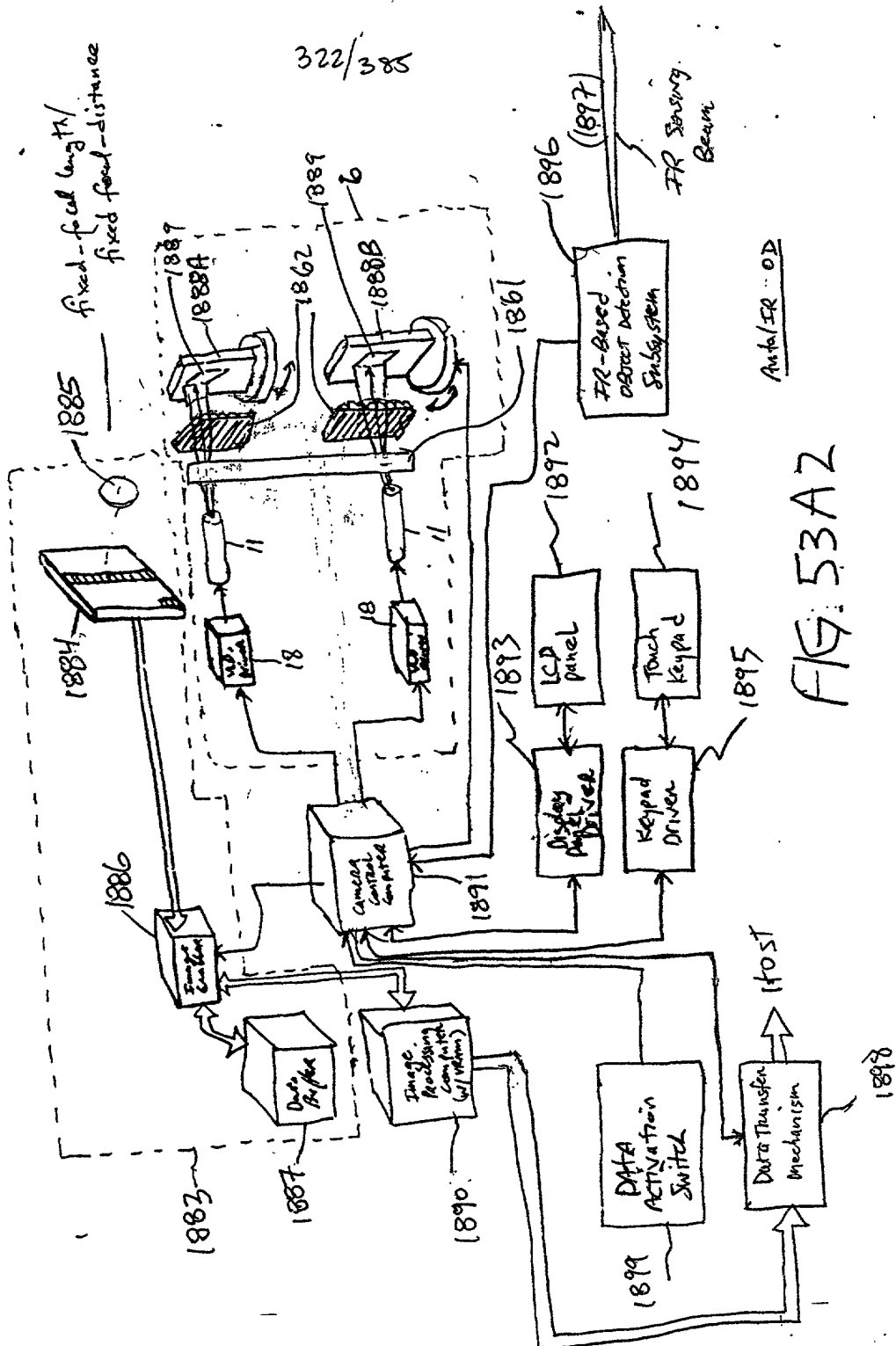
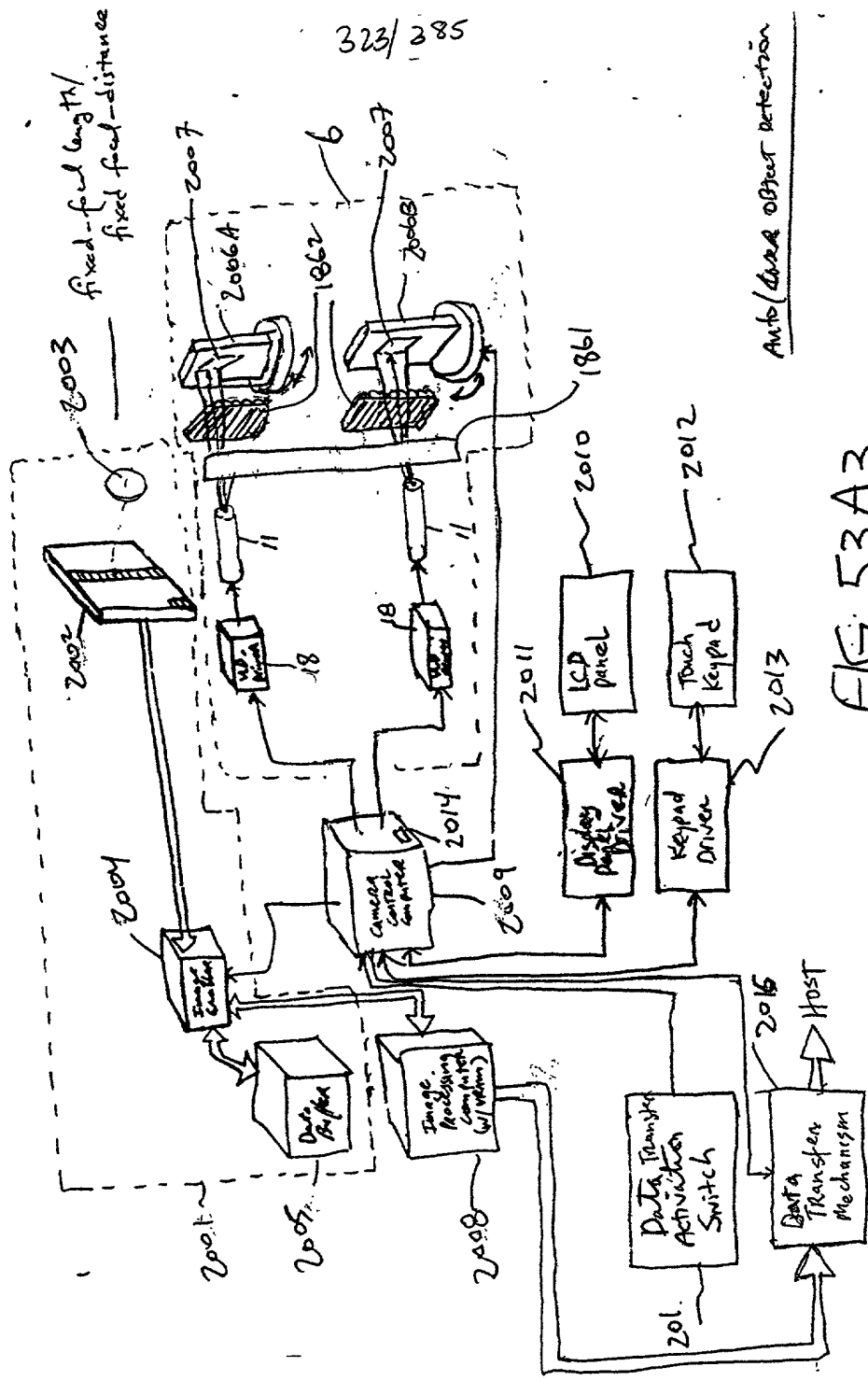


FIG. 53A1

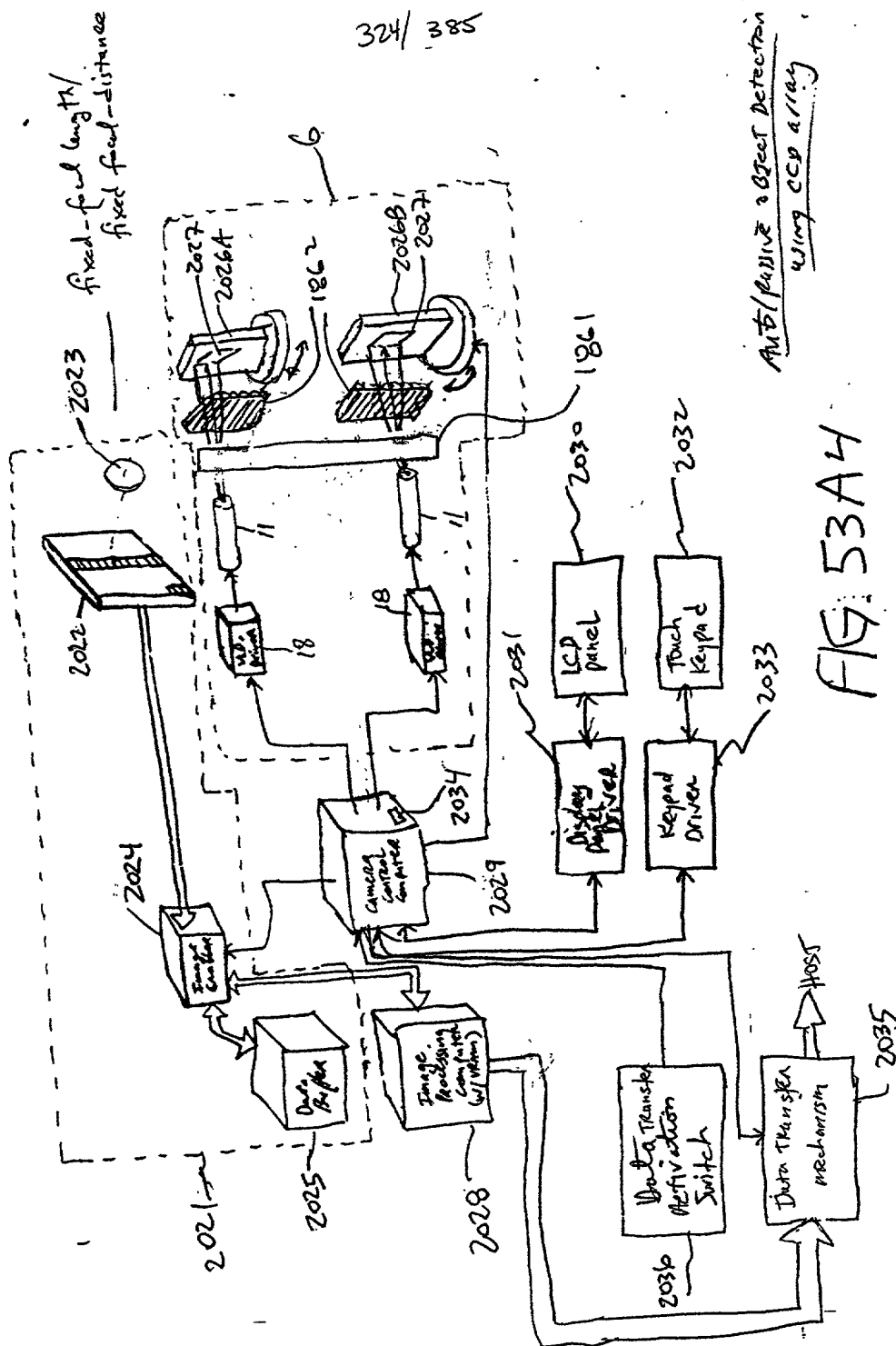
1880



2000



2020 →



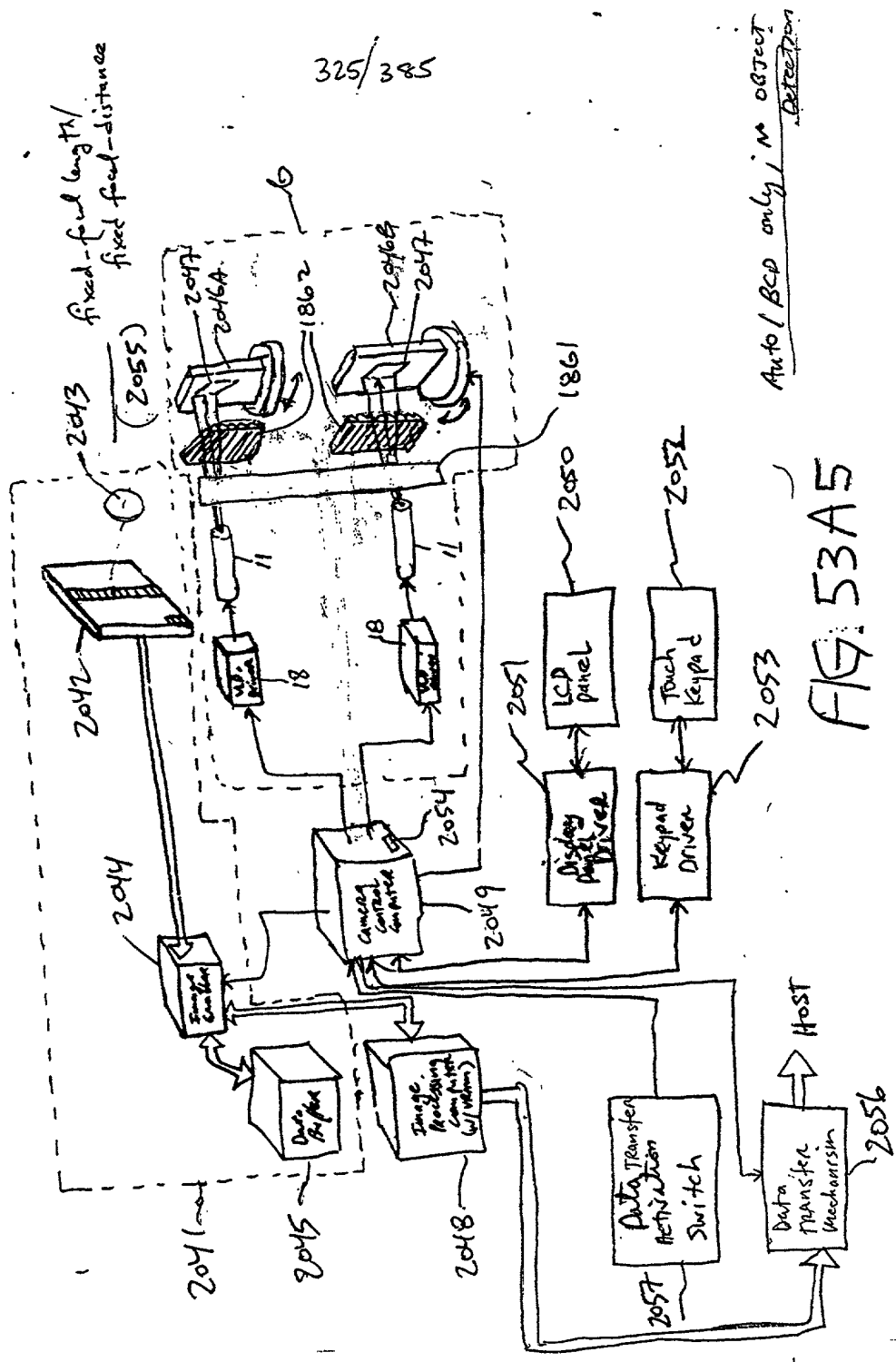
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Auto/passive object detection
using CCD array

FIG. 53A4

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2040



Auto/BCD only in object Detection

FIG. 53A5

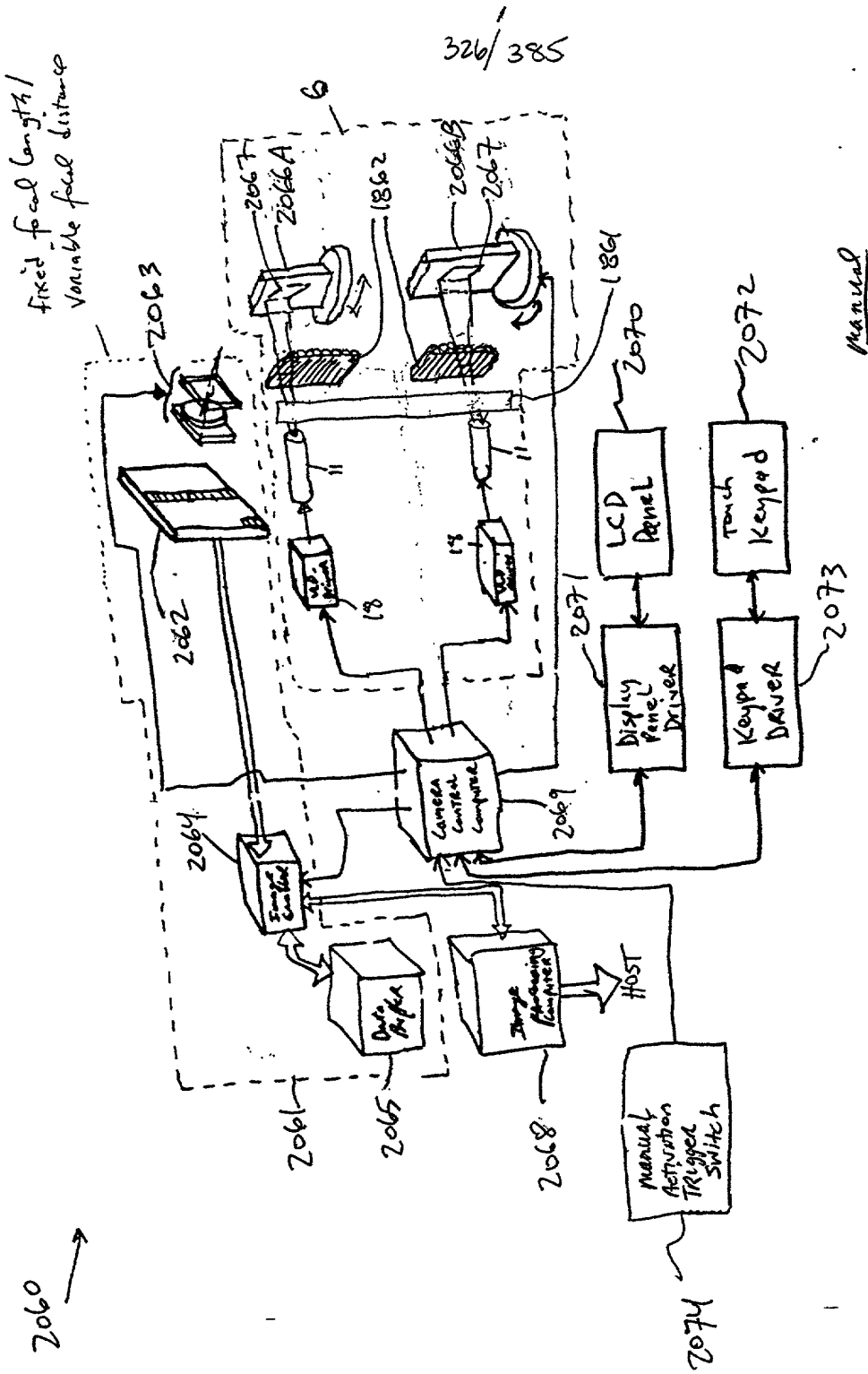
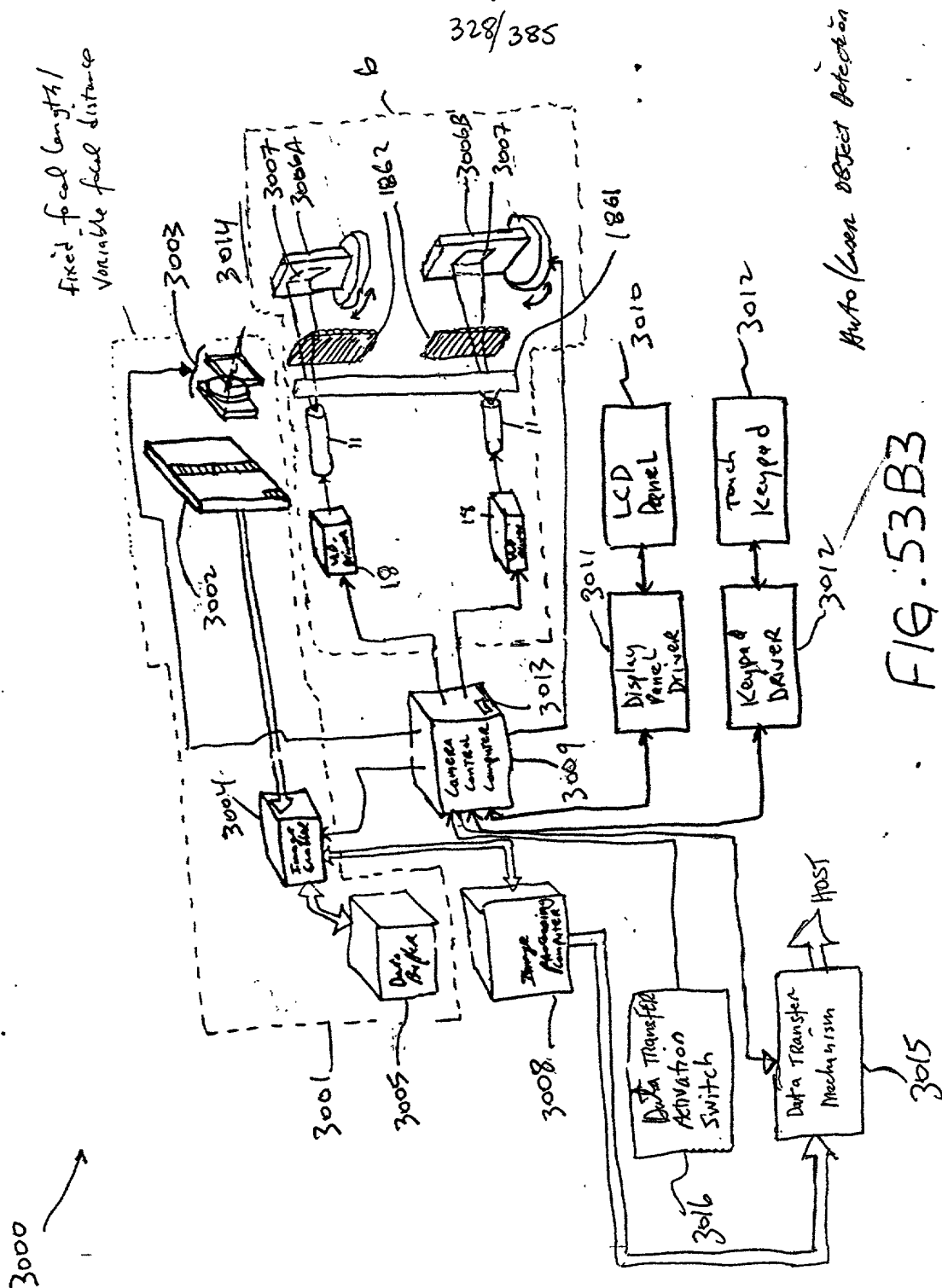


FIG. 53B1



3040 →

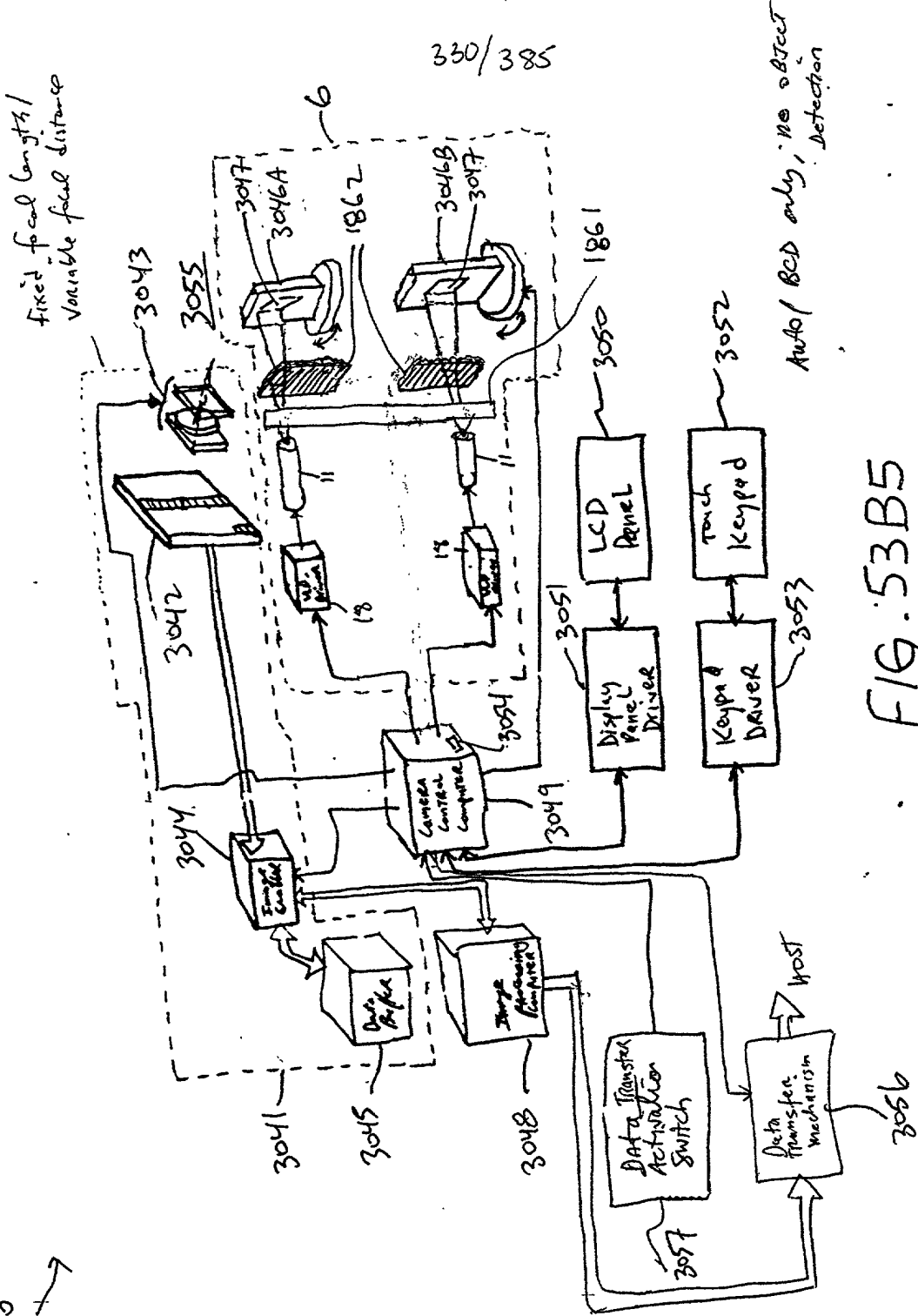
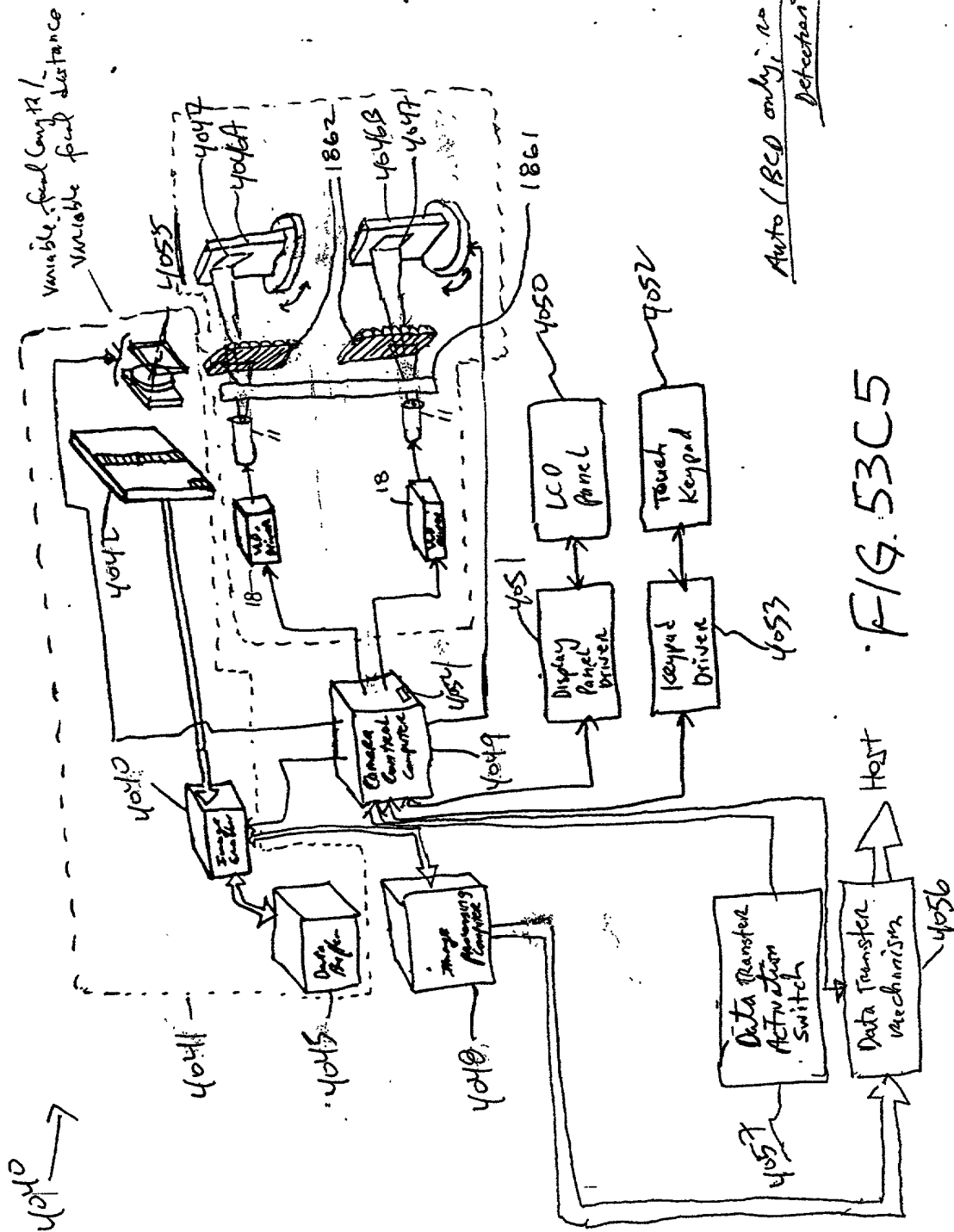


FIG. 53B5

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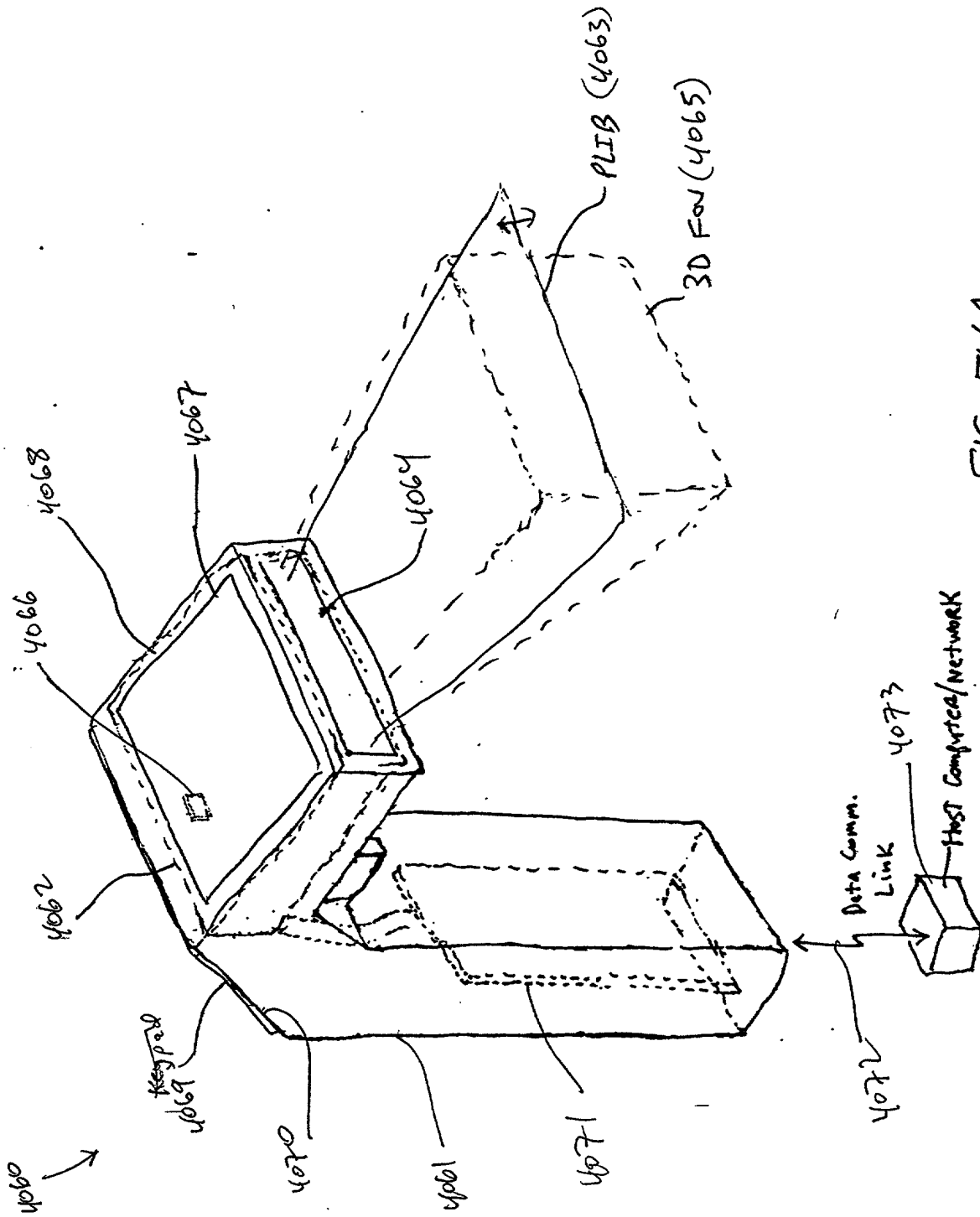


FIG. 54A

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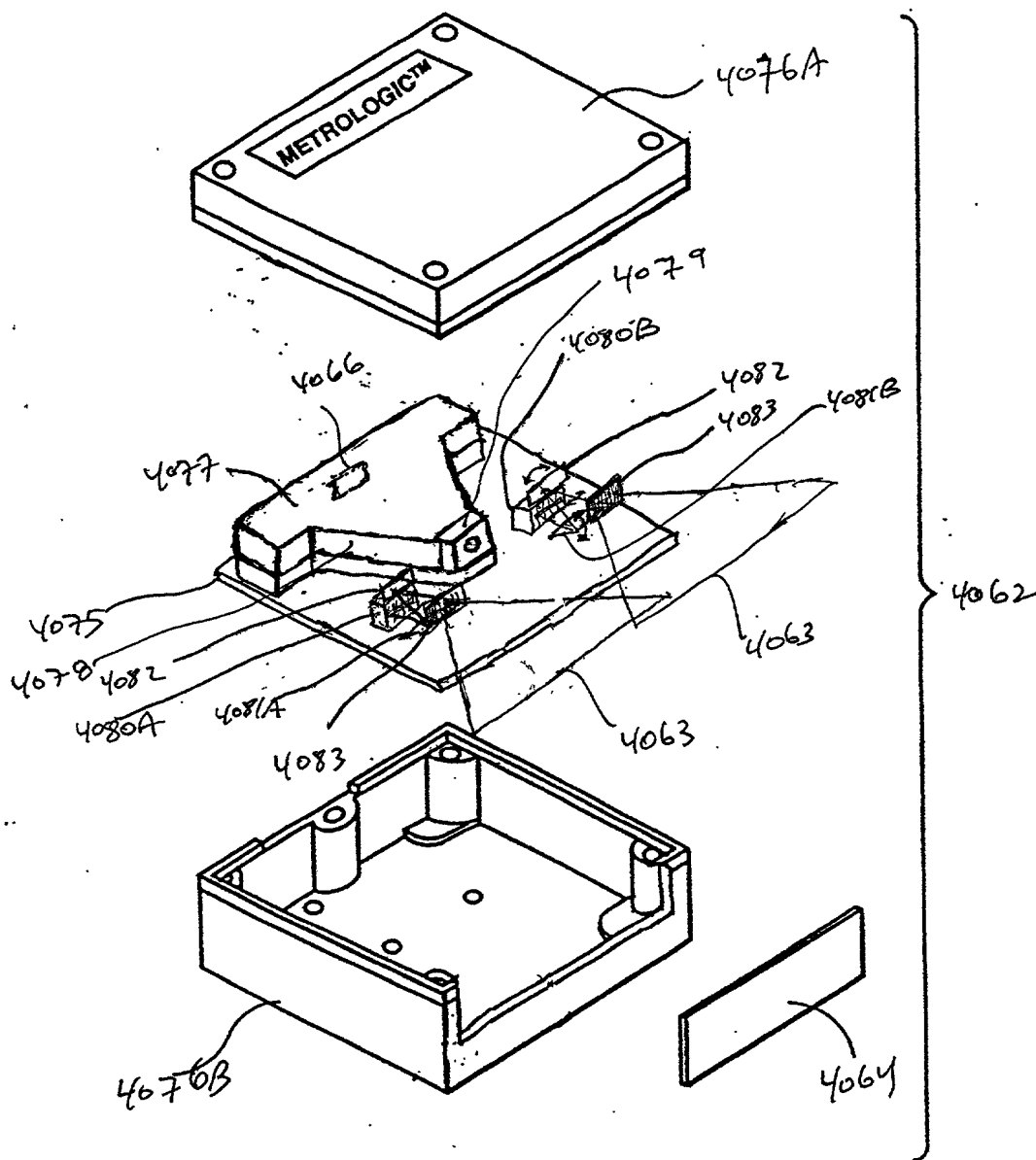


FIG. 54B

(dual mirrors)

Fig. 175A-SP1

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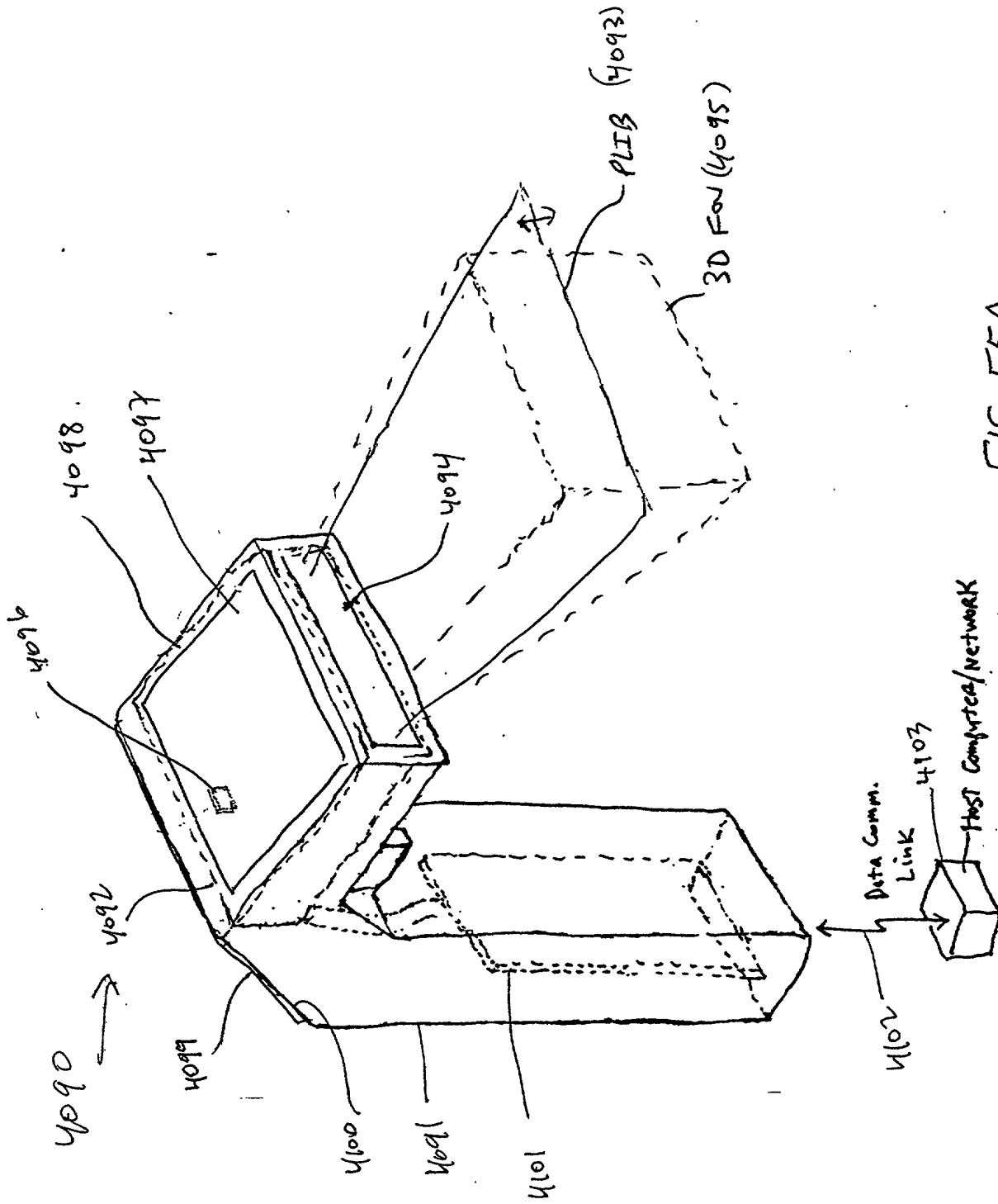


FIG. 55A

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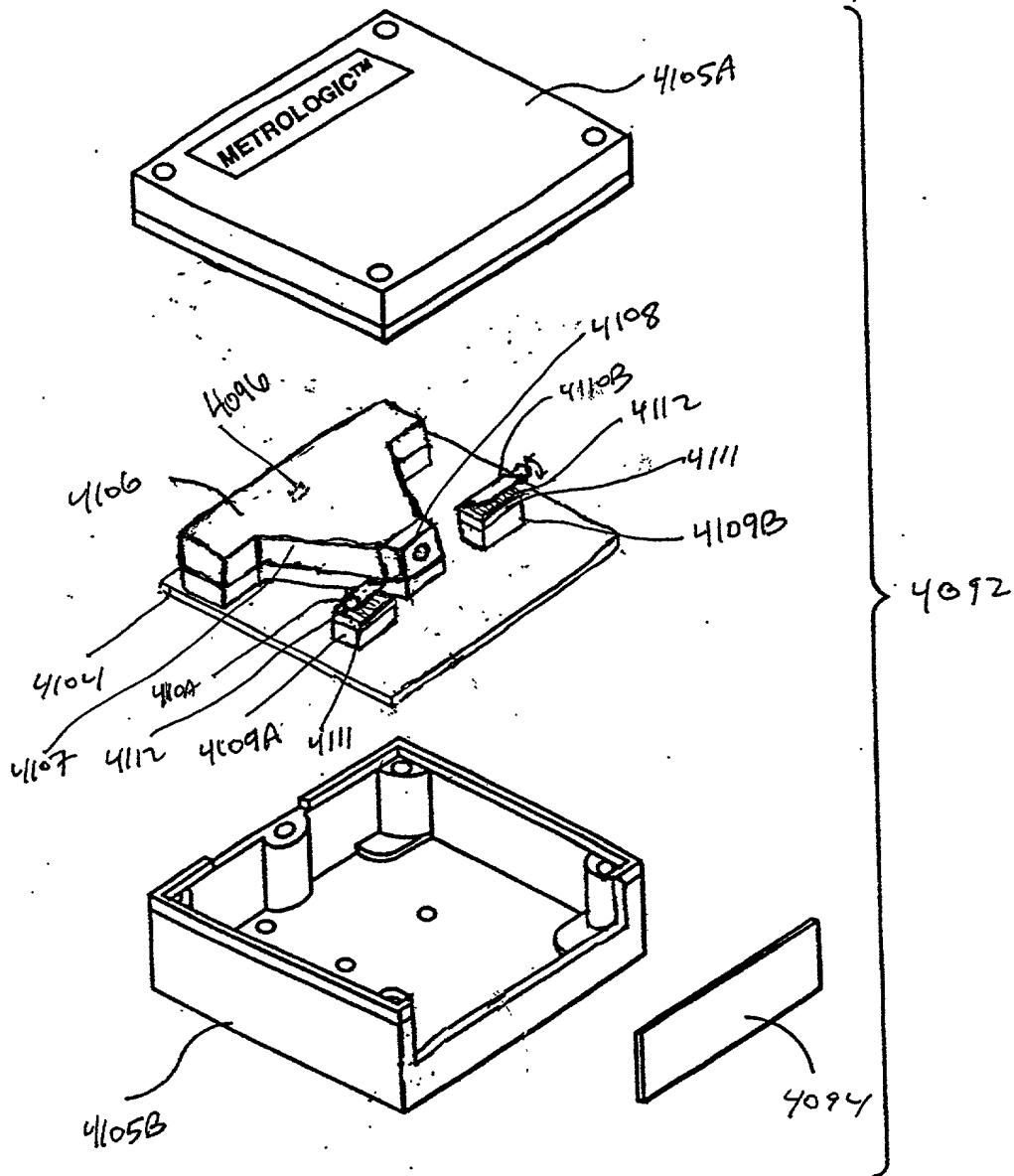


FIG. 55B

Brooks cell
Fig. 126A-6B

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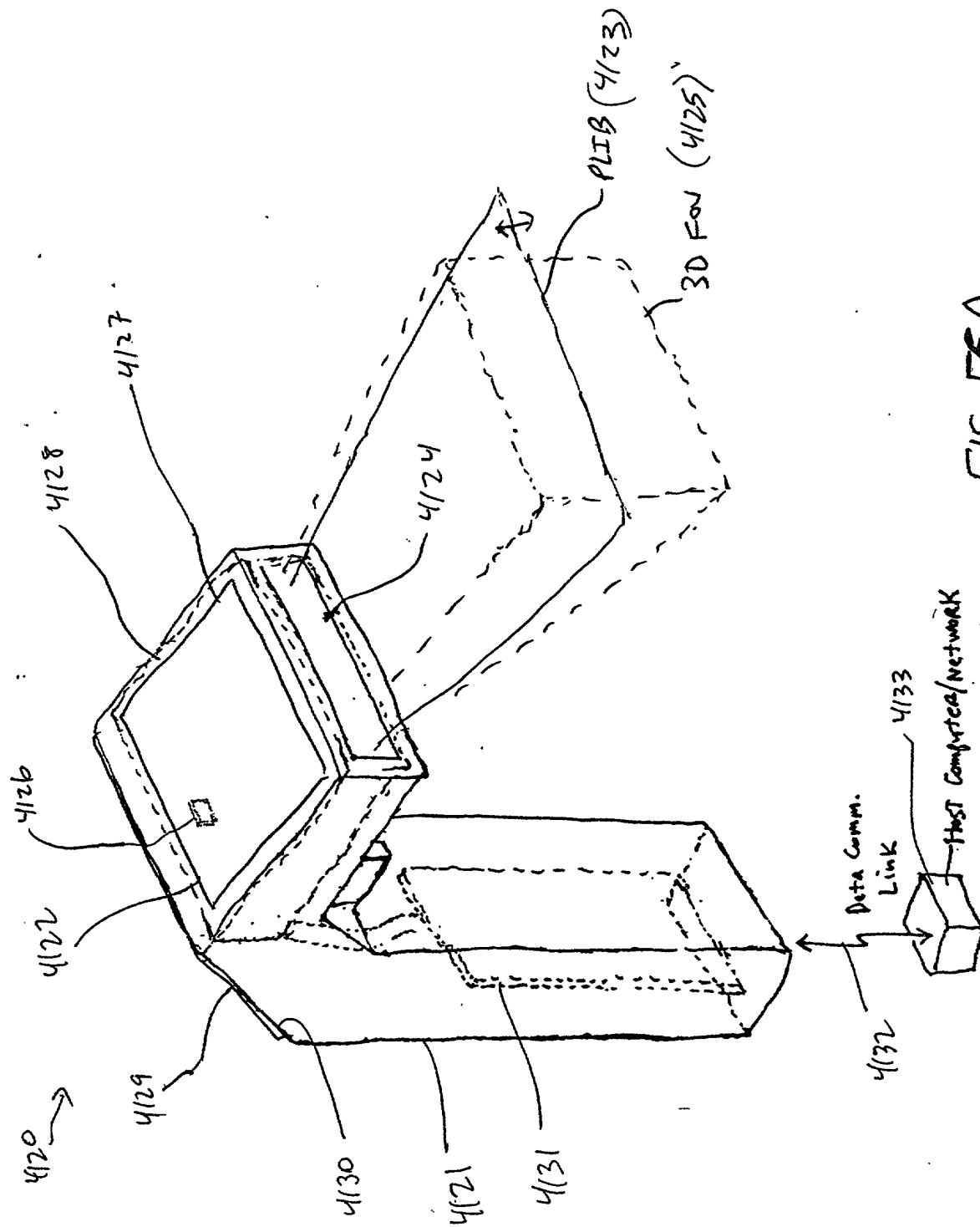


FIG. 56A

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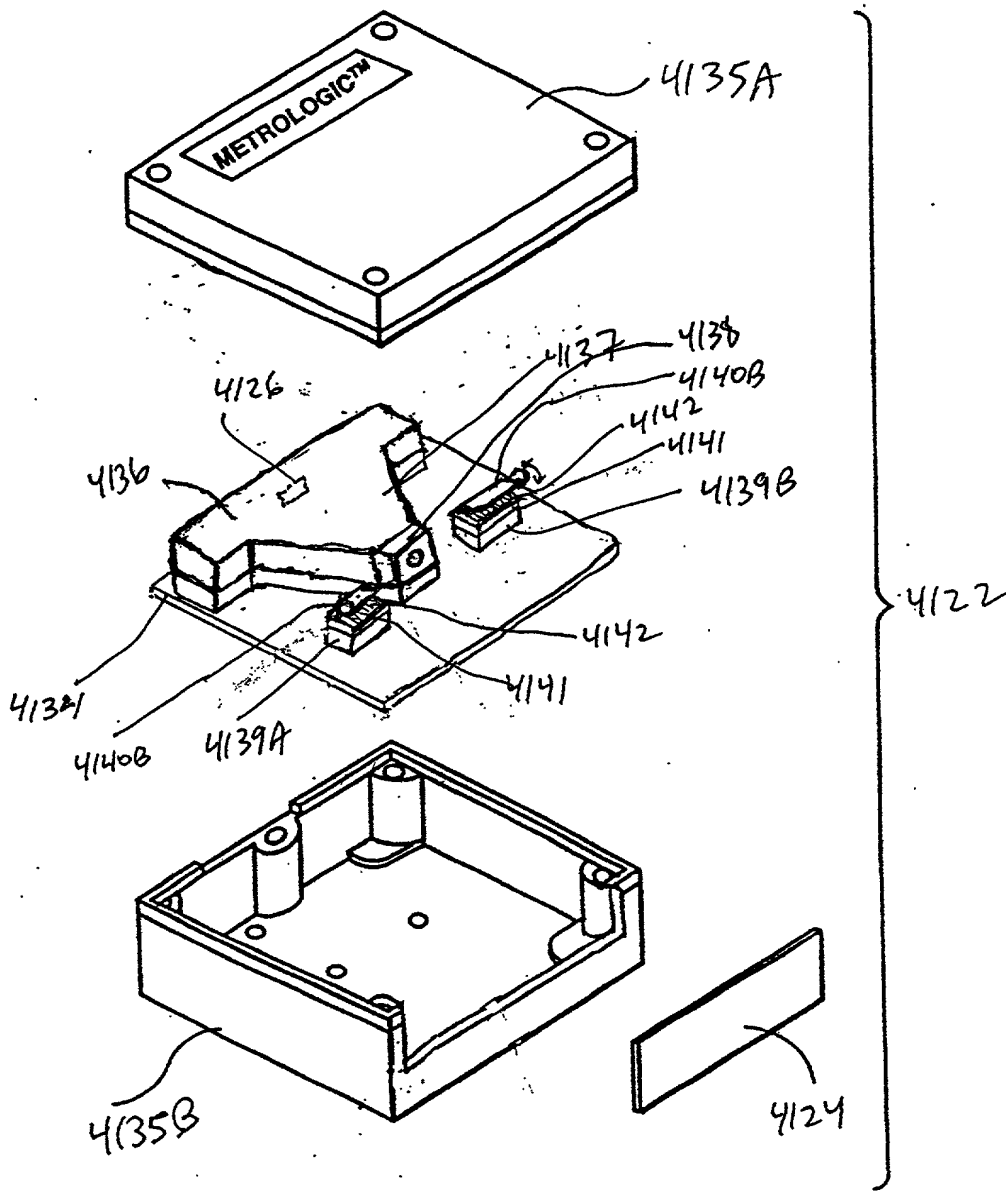
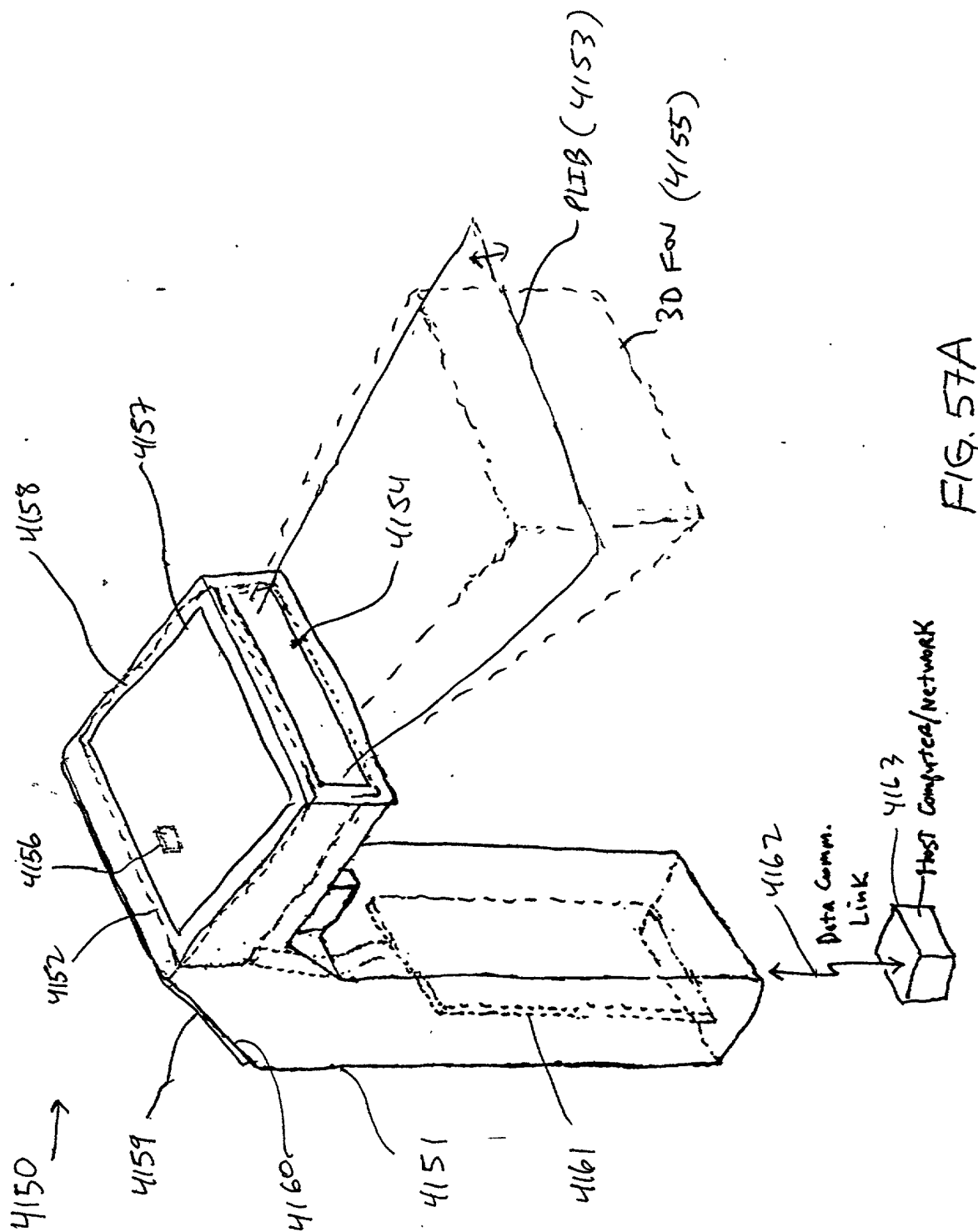


FIG. 56B

DM

Fig. 1I 7A-7C



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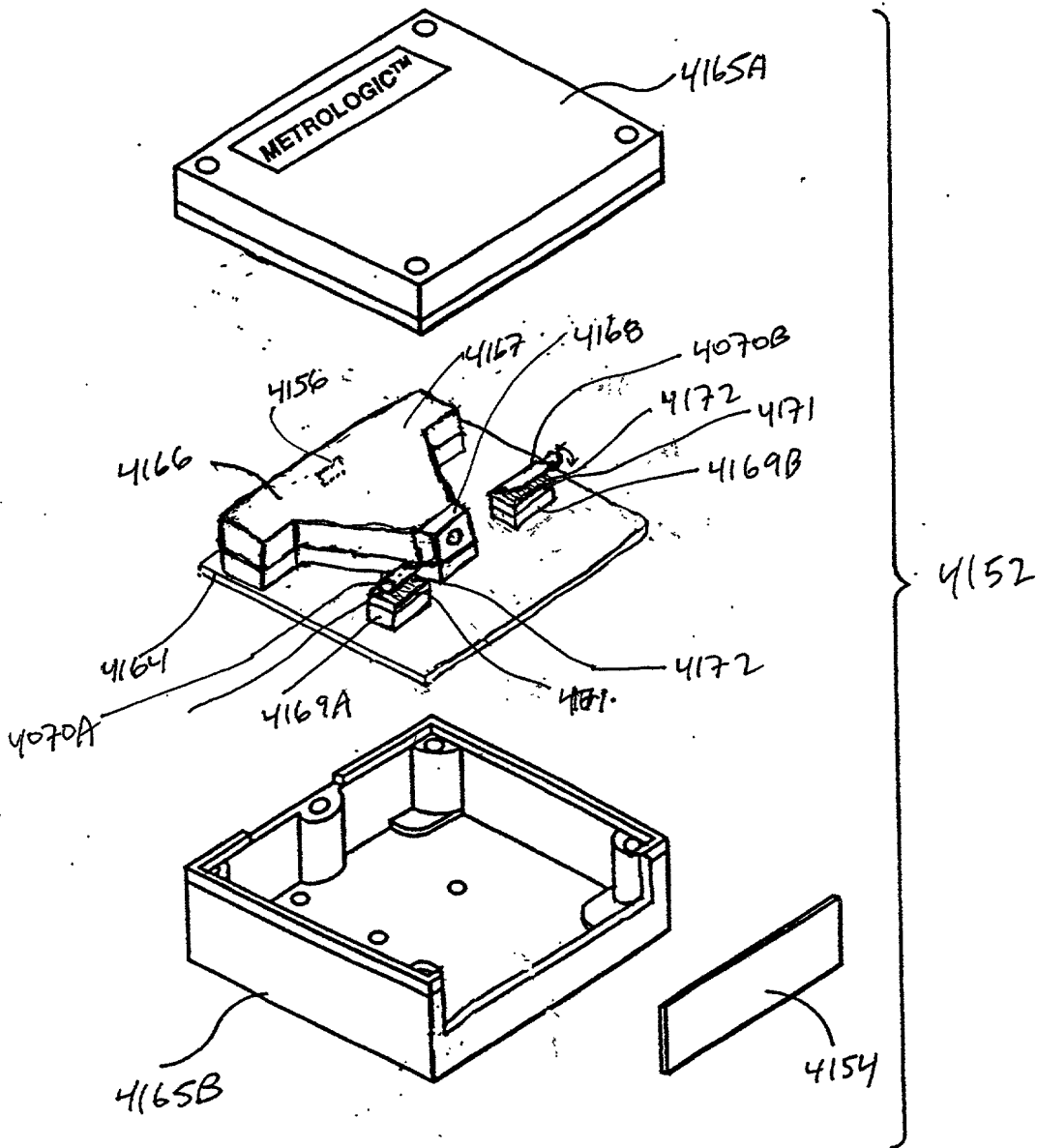


FIG. 57B

Phase only LCR
pin panel

Figs 1F 8F-8G

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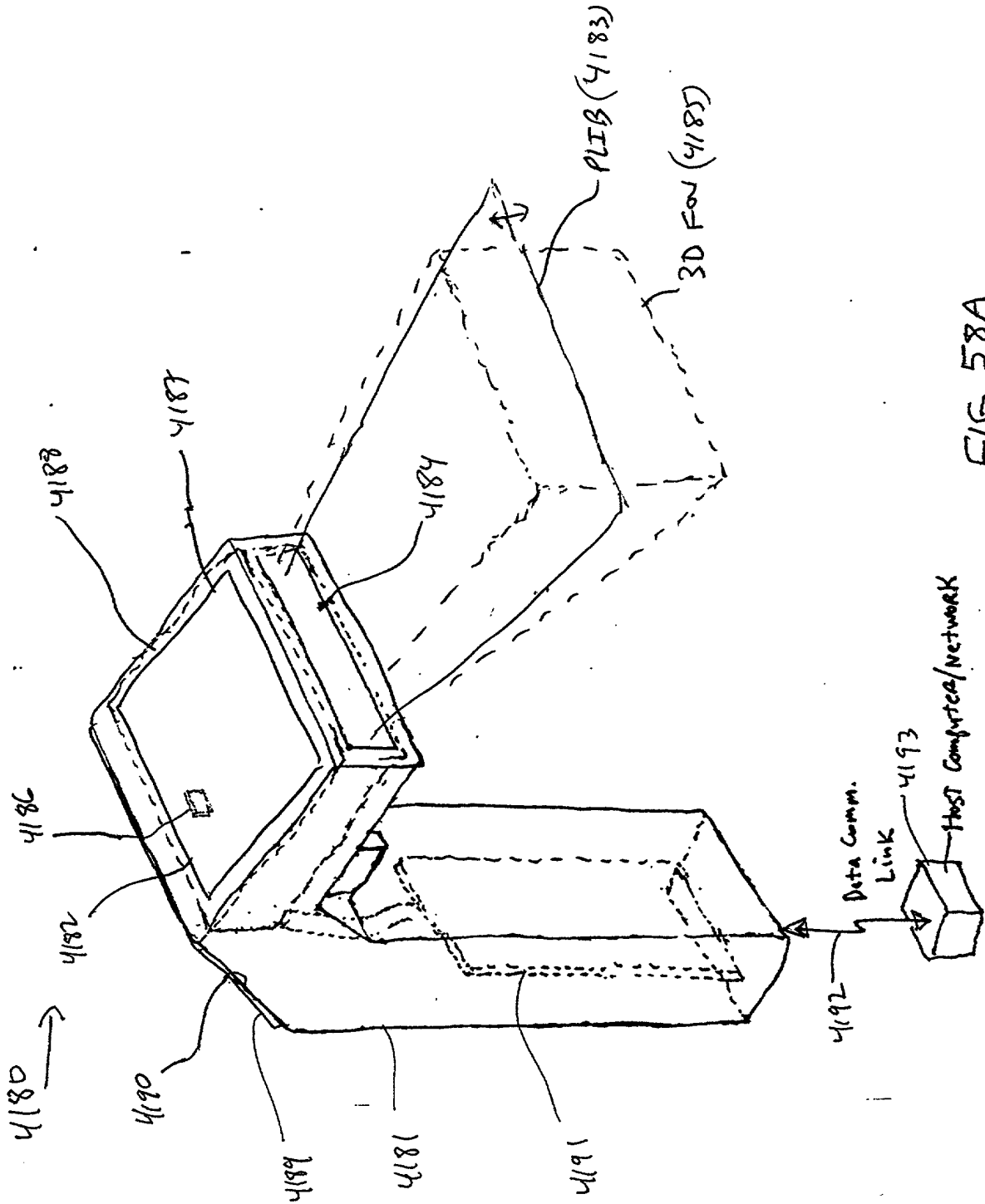


FIG. 58A

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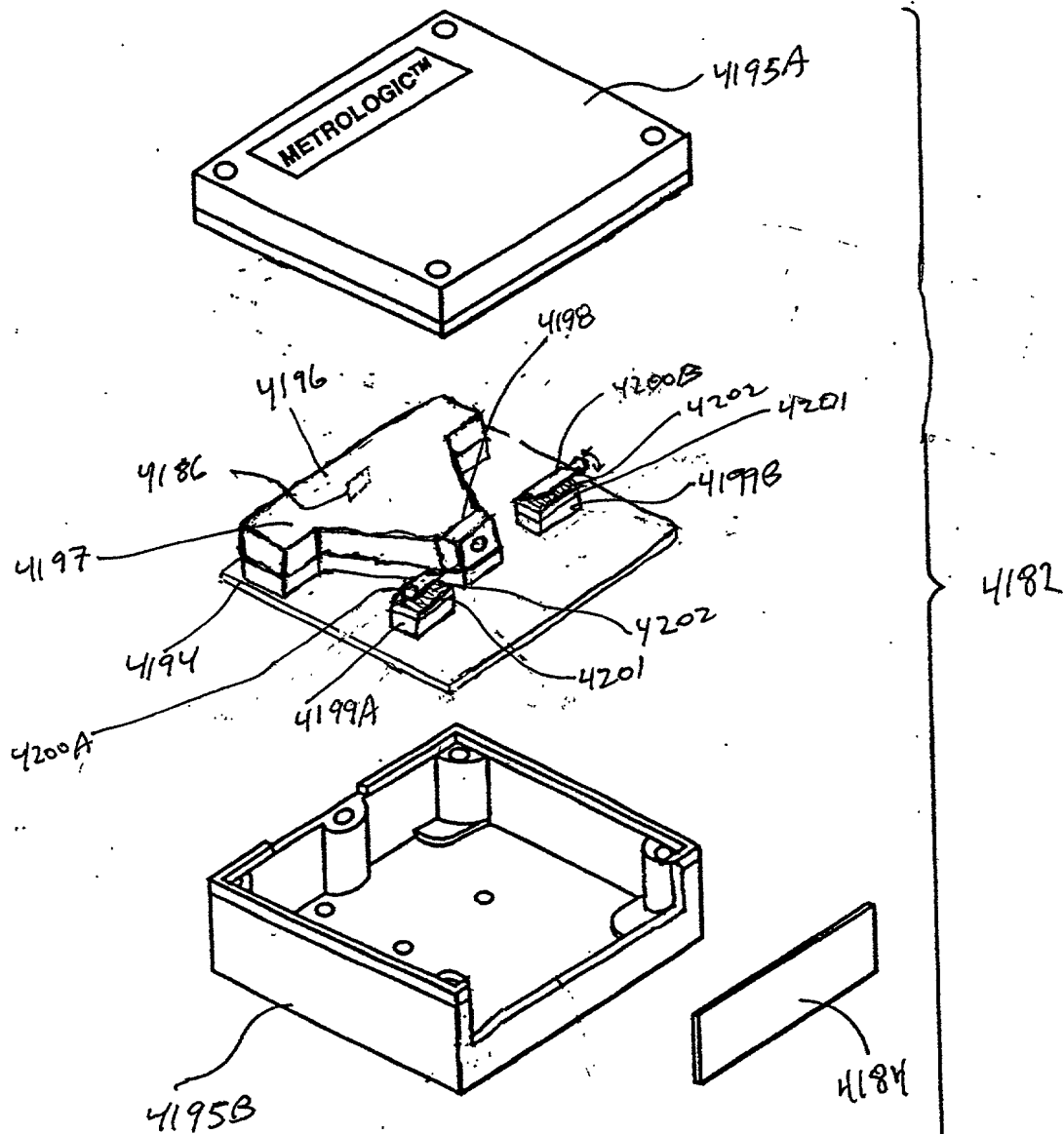


FIG. 58B

115 optical sensor
Fig. 1F 14A-14B

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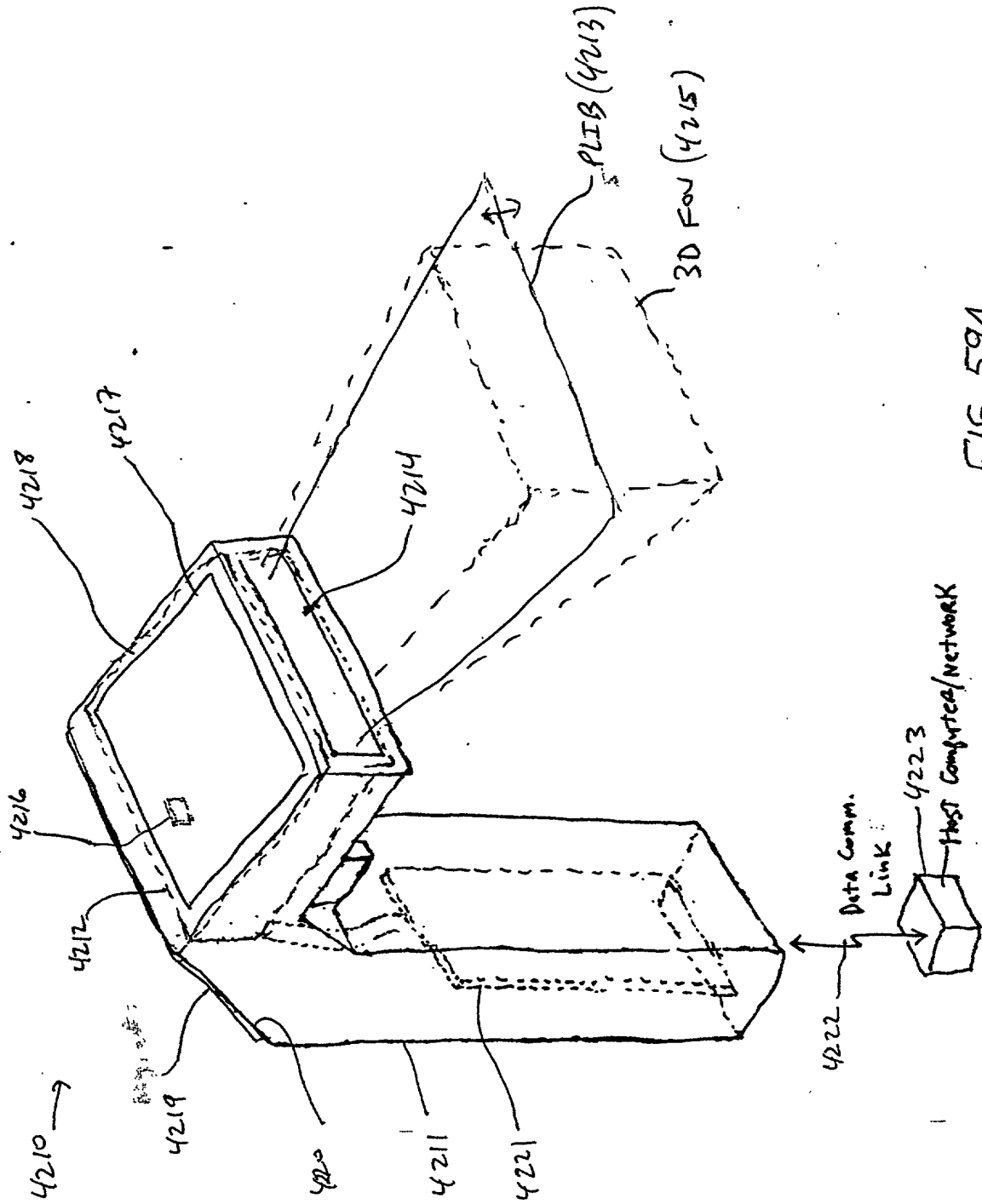


FIG. 59A

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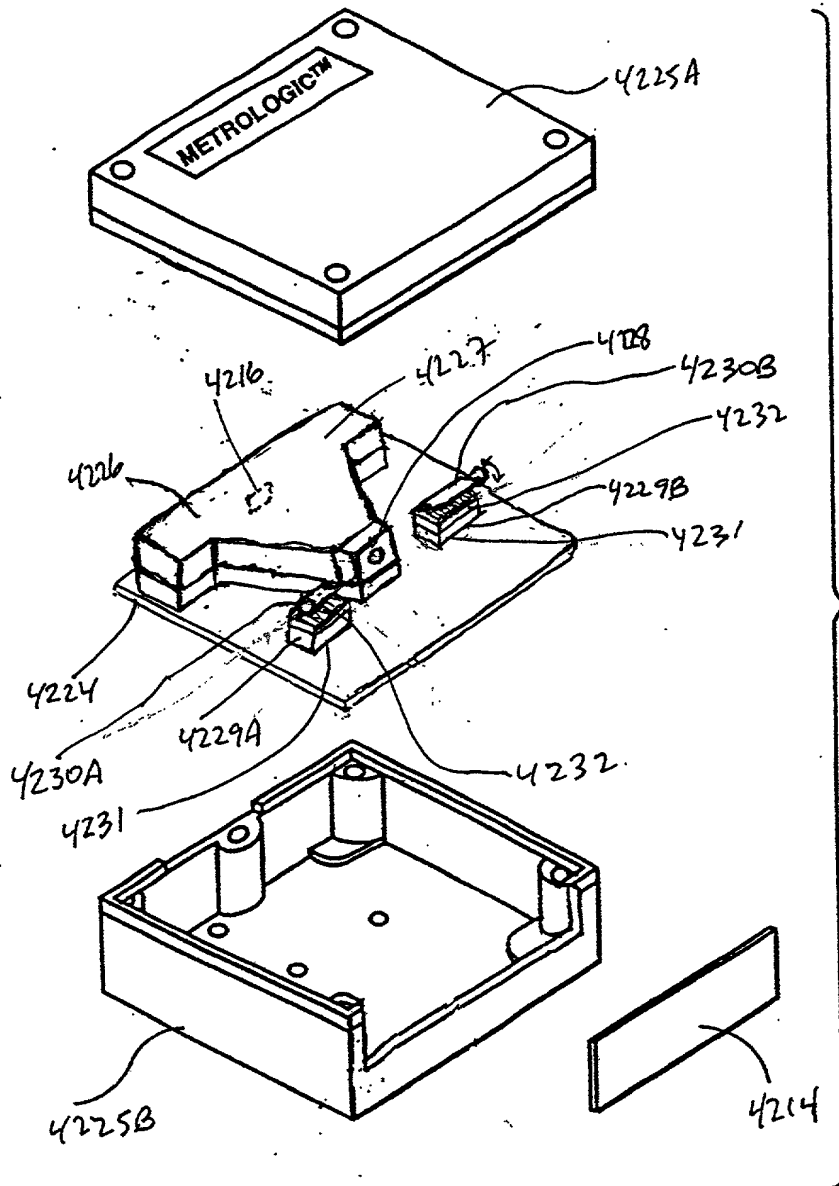


FIG. 59B

MLL
Fig. 1E15A-15B

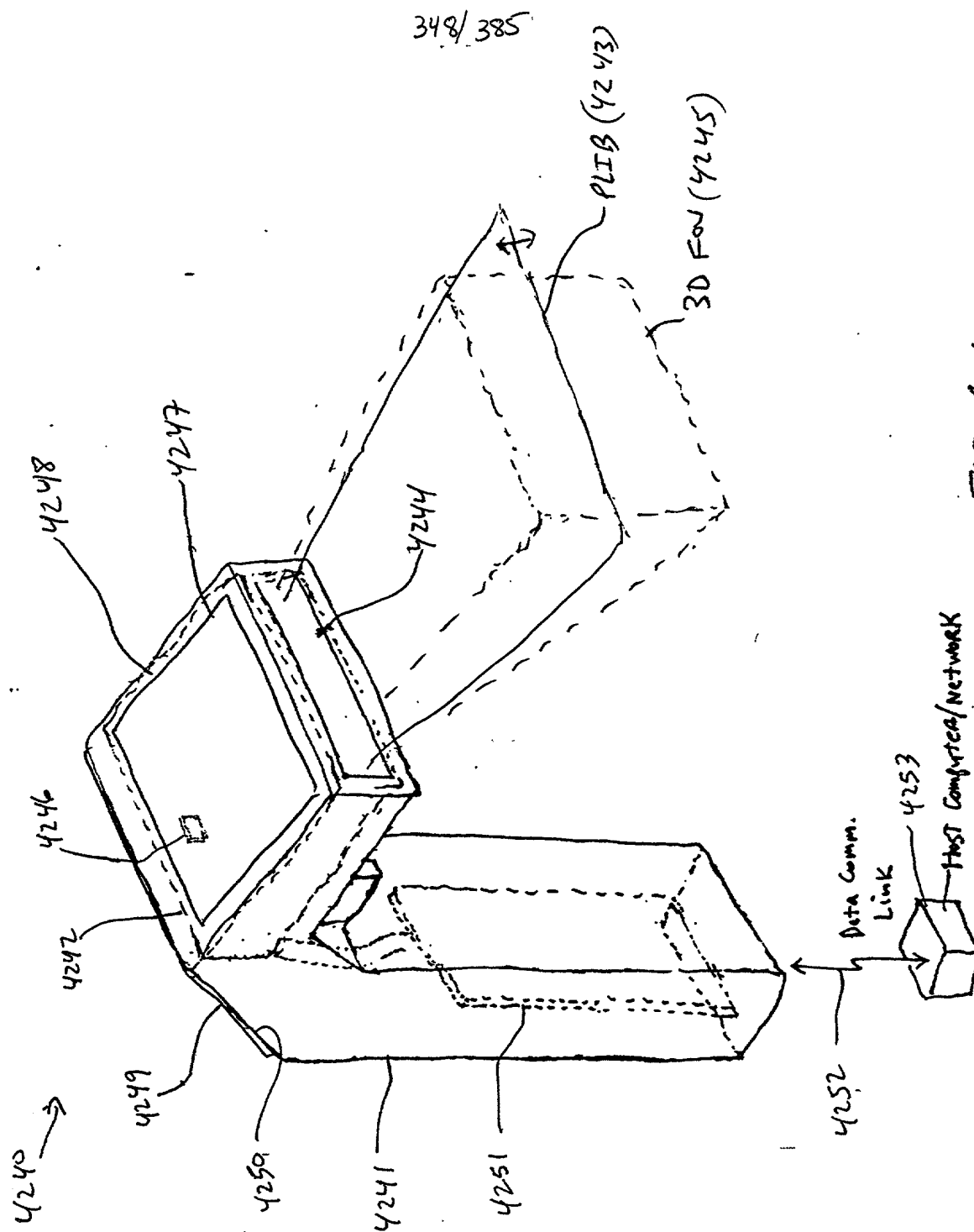


FIG. 60A

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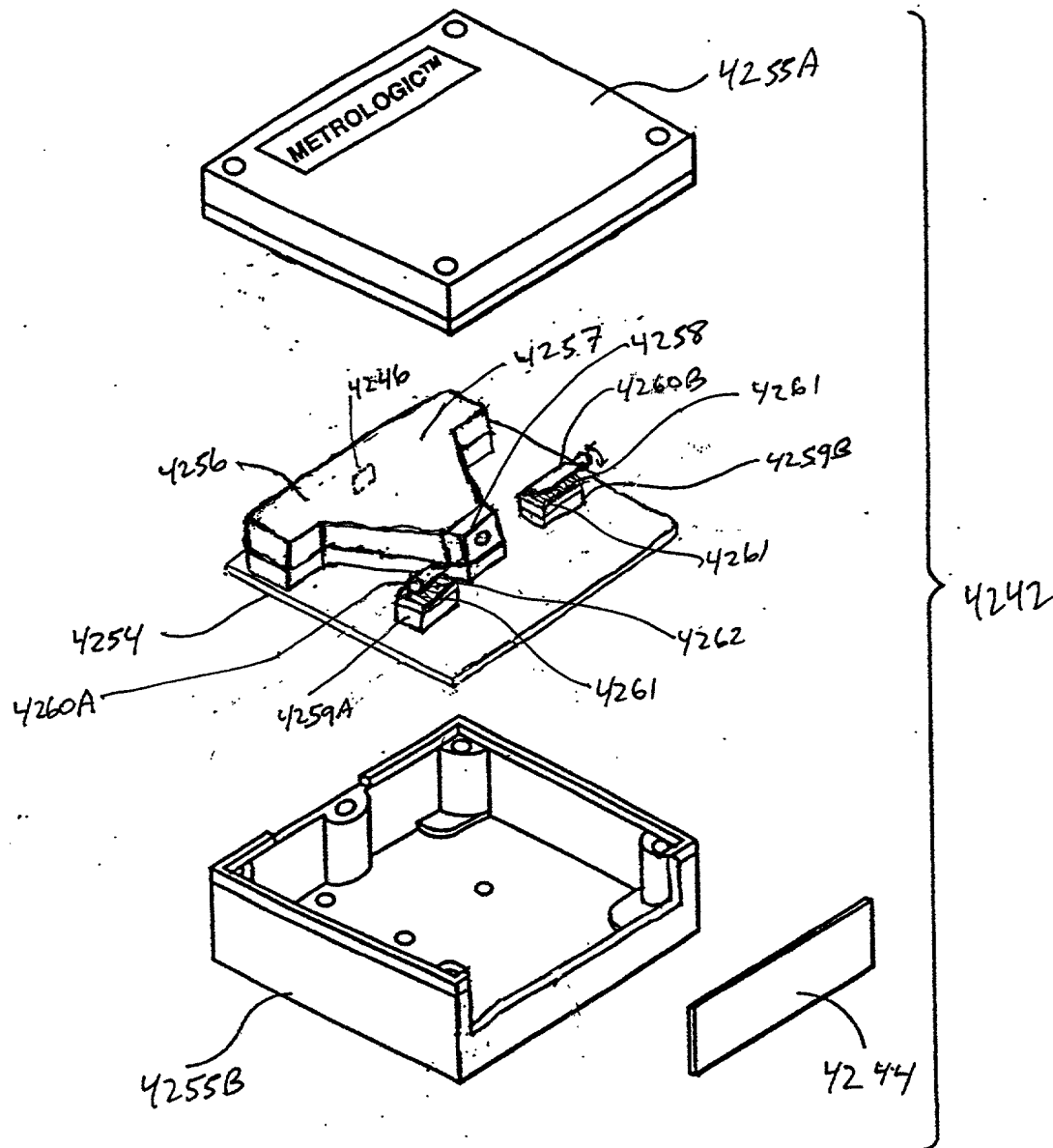


FIG. 60B

Bethalco (Trans. phase mod.)
Fig. 117A-17B

00000585-1101
00000585-1101

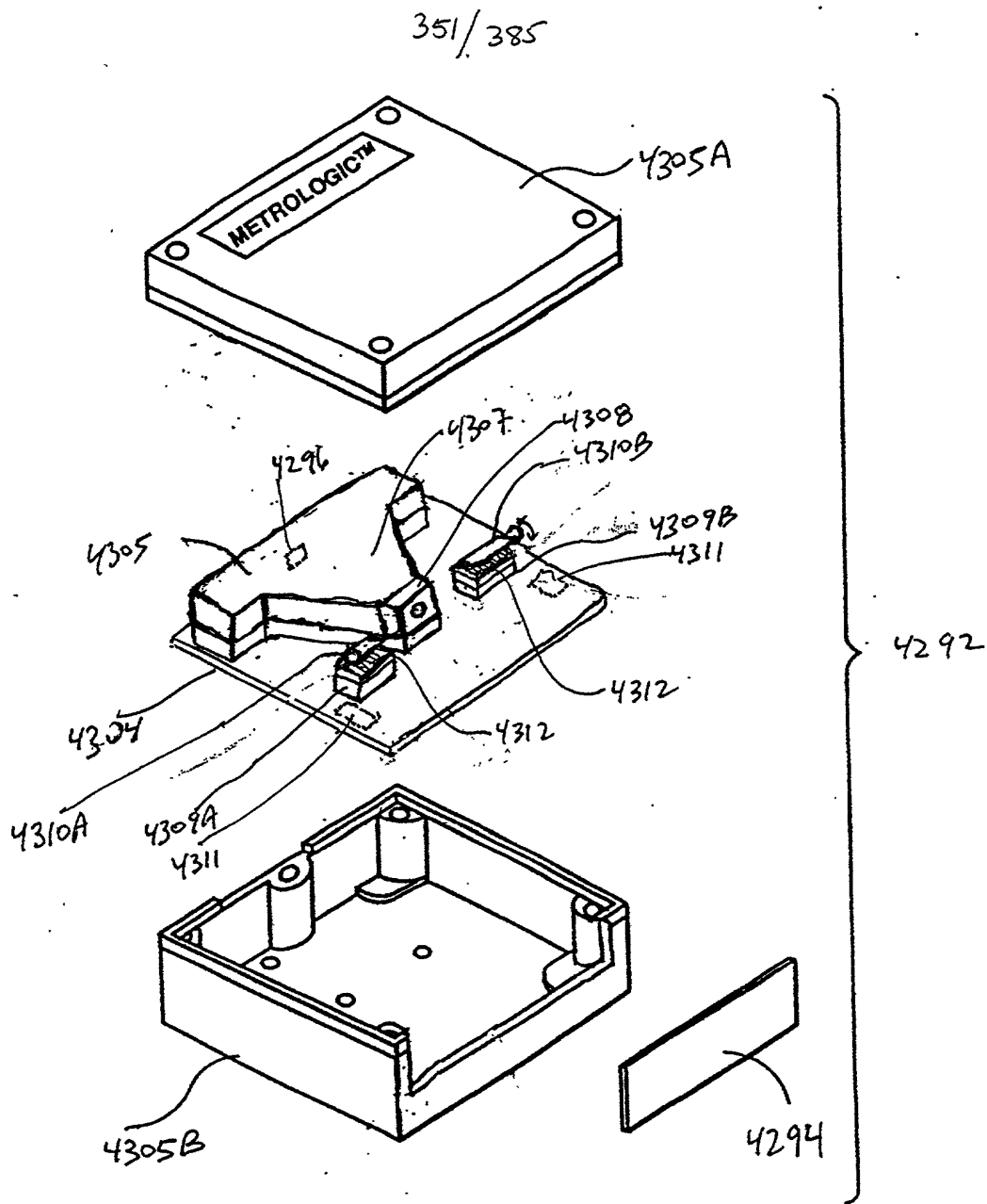


FIG. 61B

mod. hugging

Fig. 1A-19B

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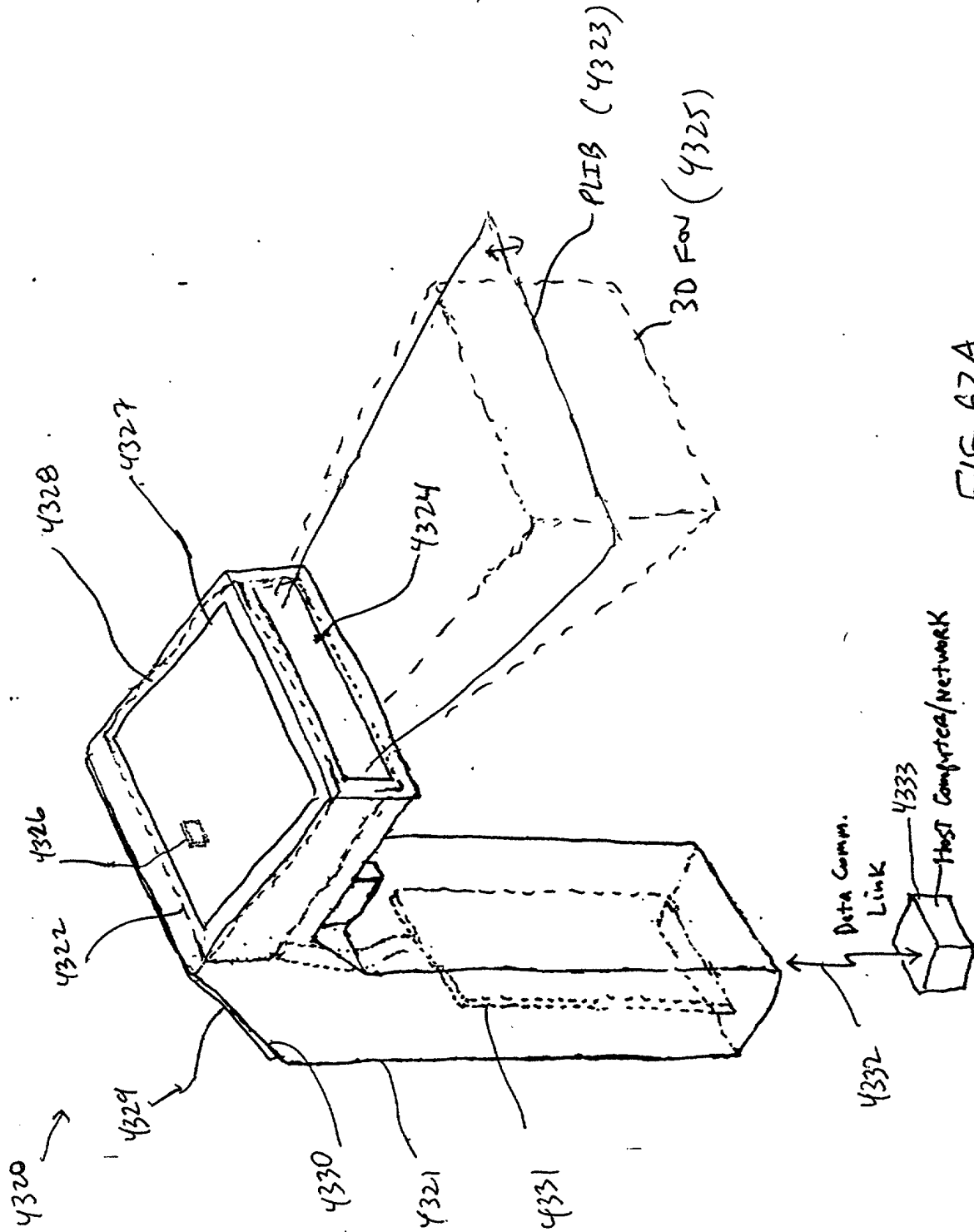


FIG. 62A

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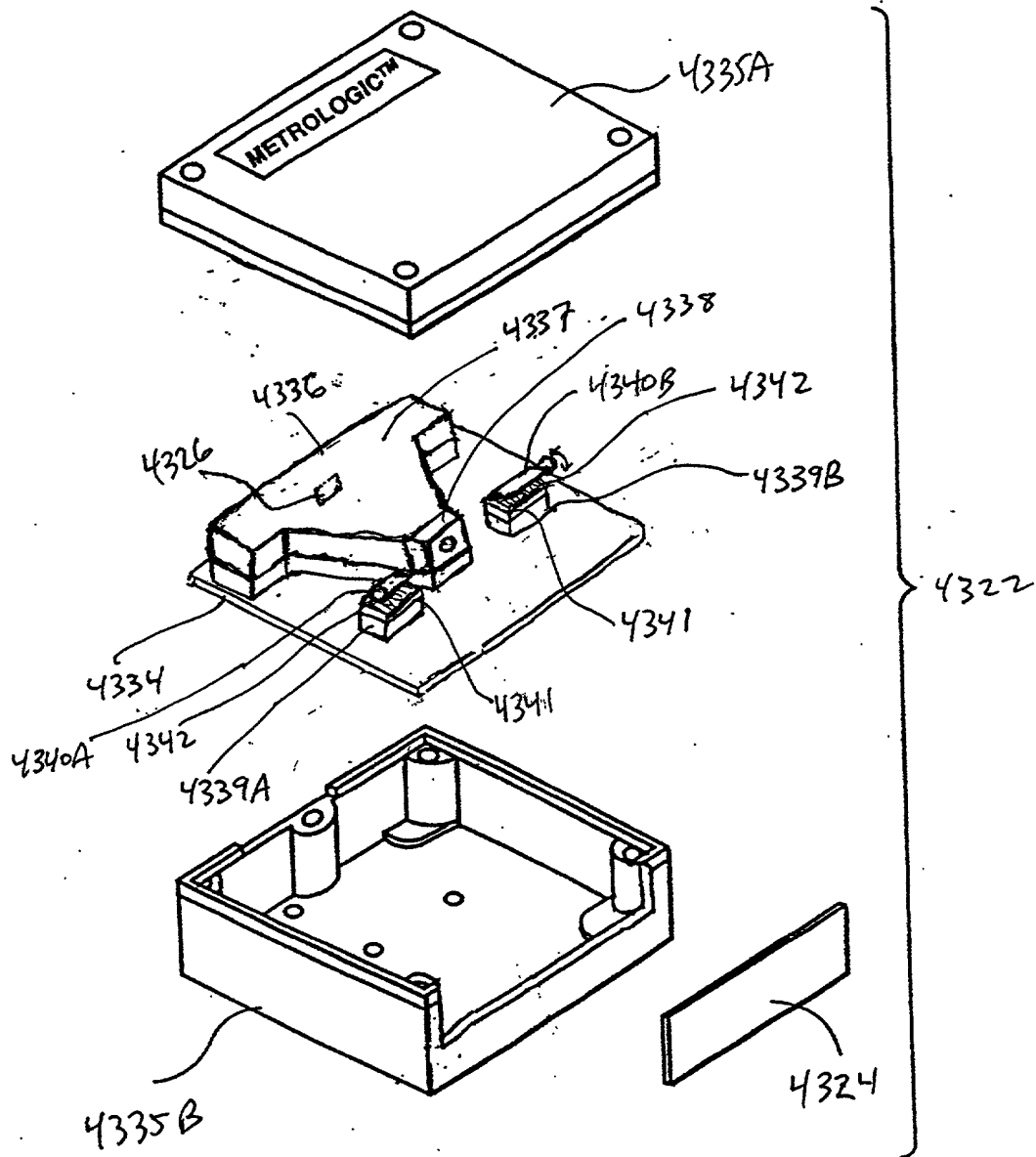


FIG. 62B

measuring
spot intensity
mod. panel

Fig. 1F21A-21D

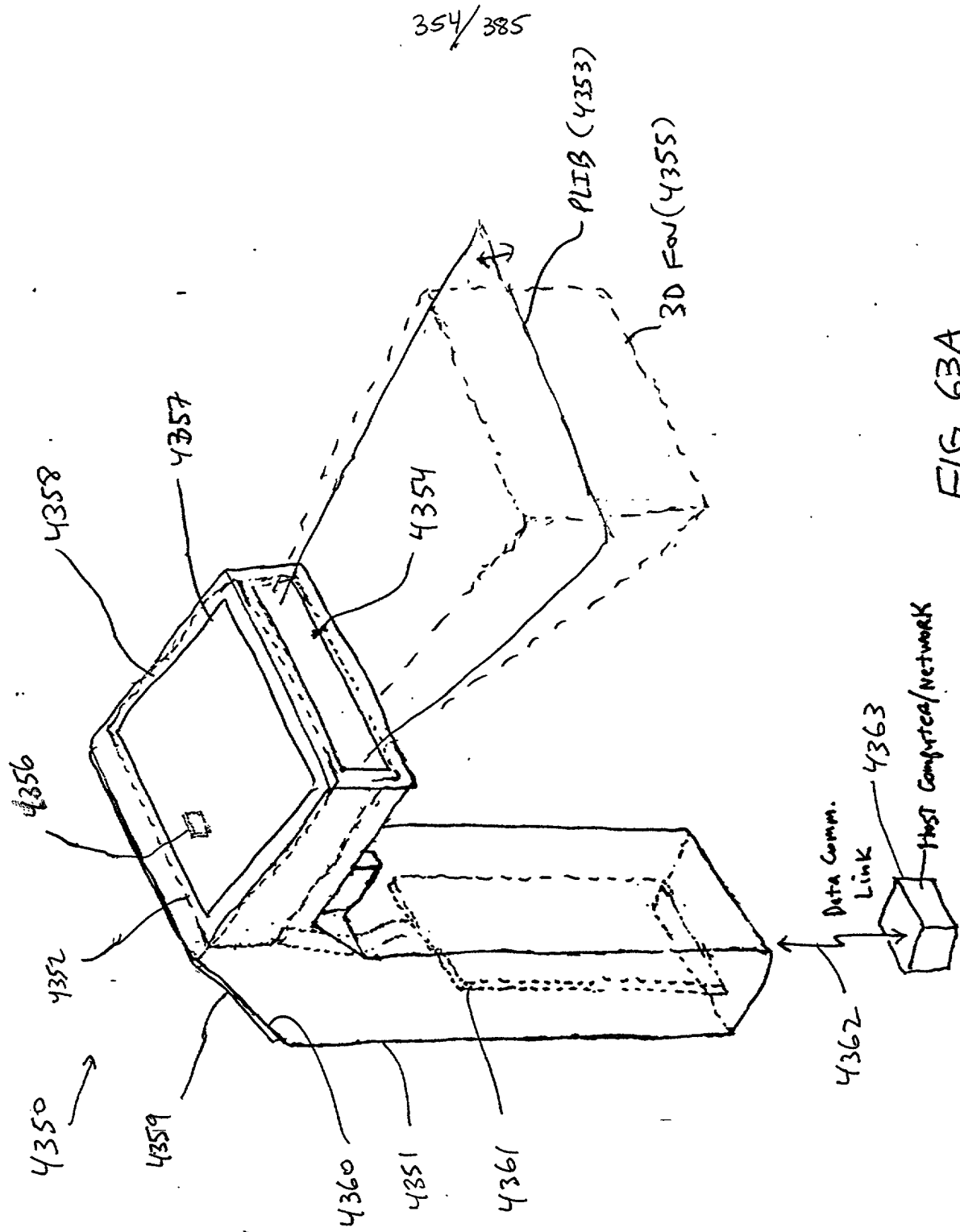


FIG. 63A

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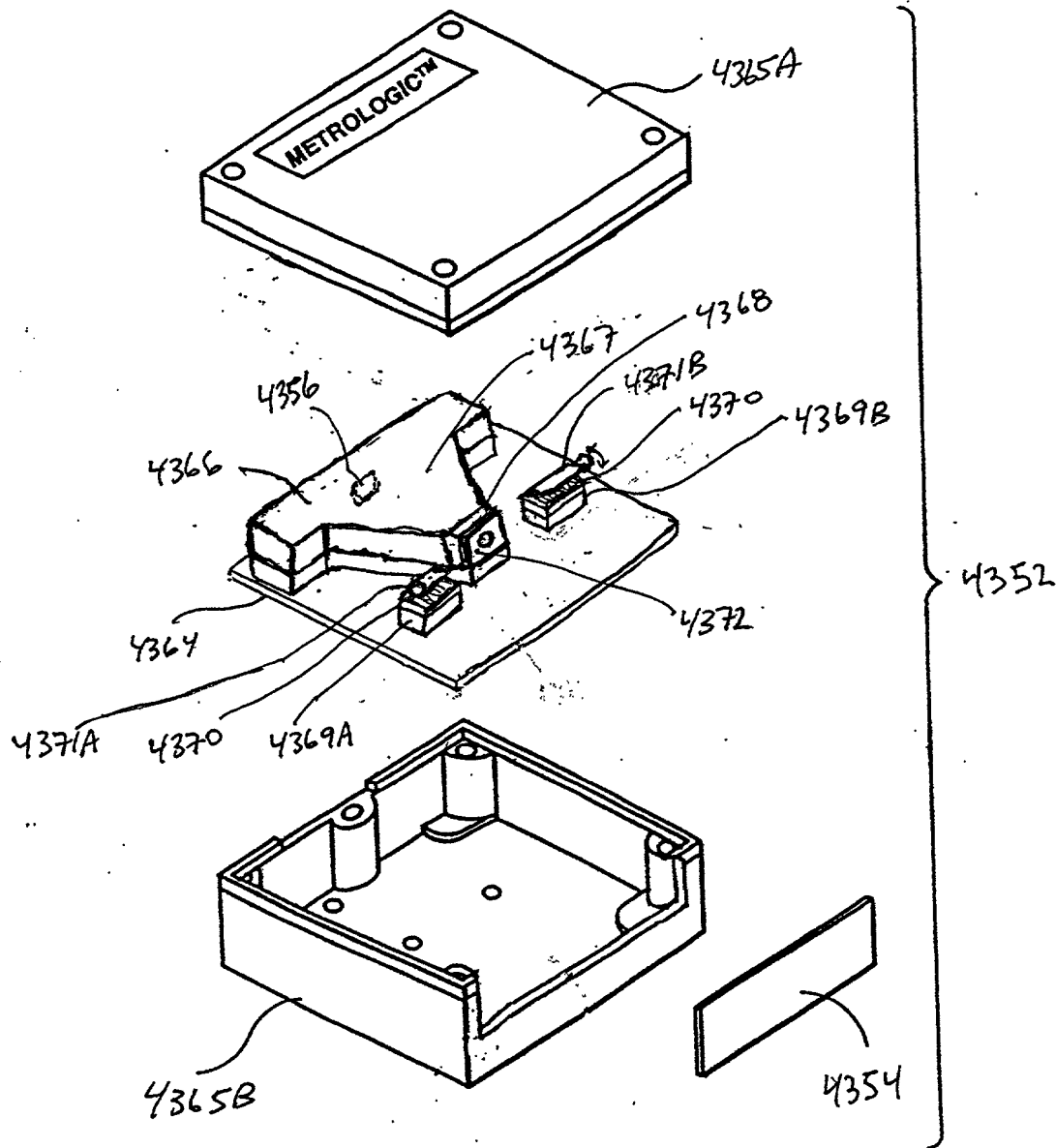


FIG. 63B

ED 06.
Mechanical Rotating Iris

Fig 1F
23A-23B

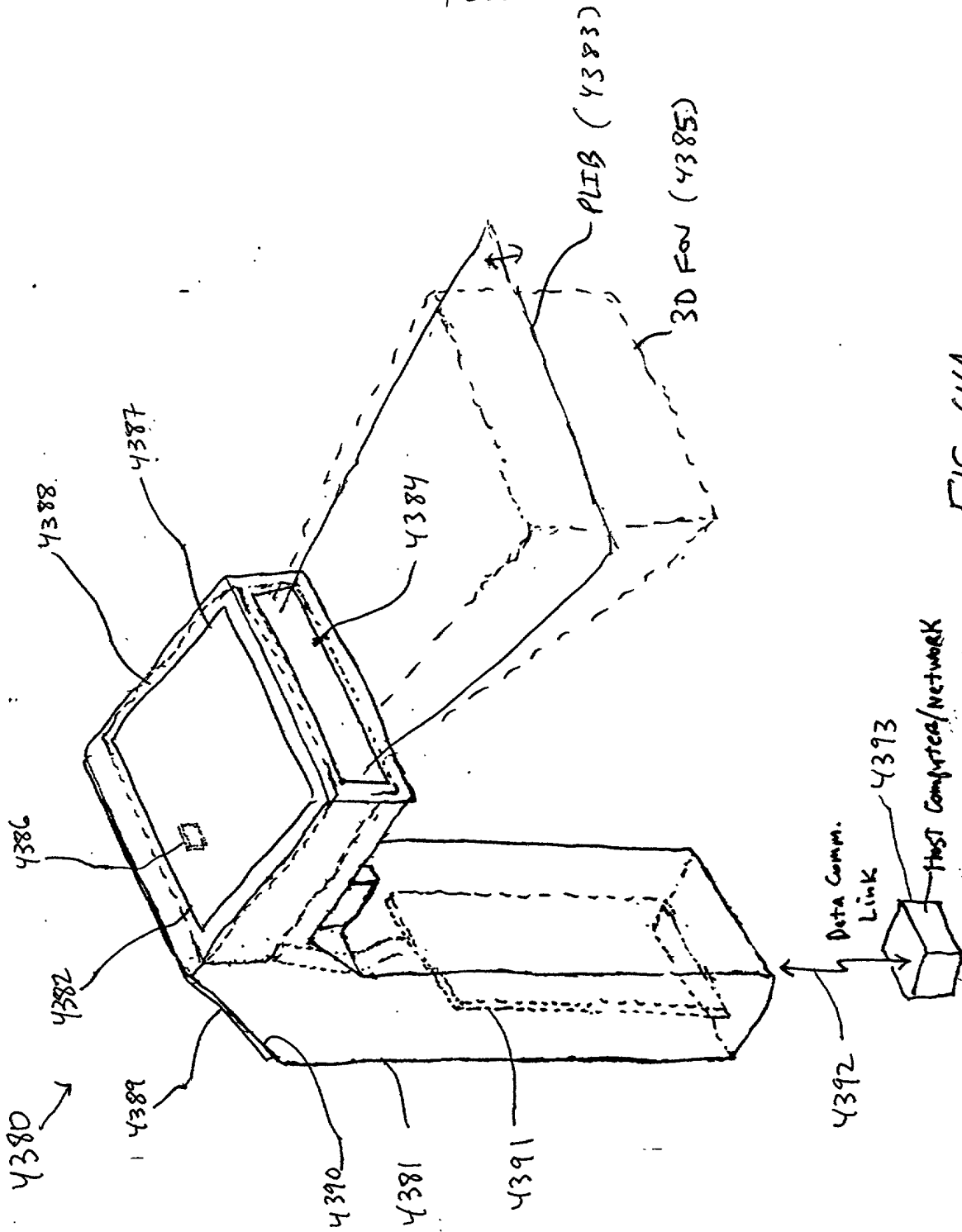


FIG. 64A

00000586443104
10121198060600

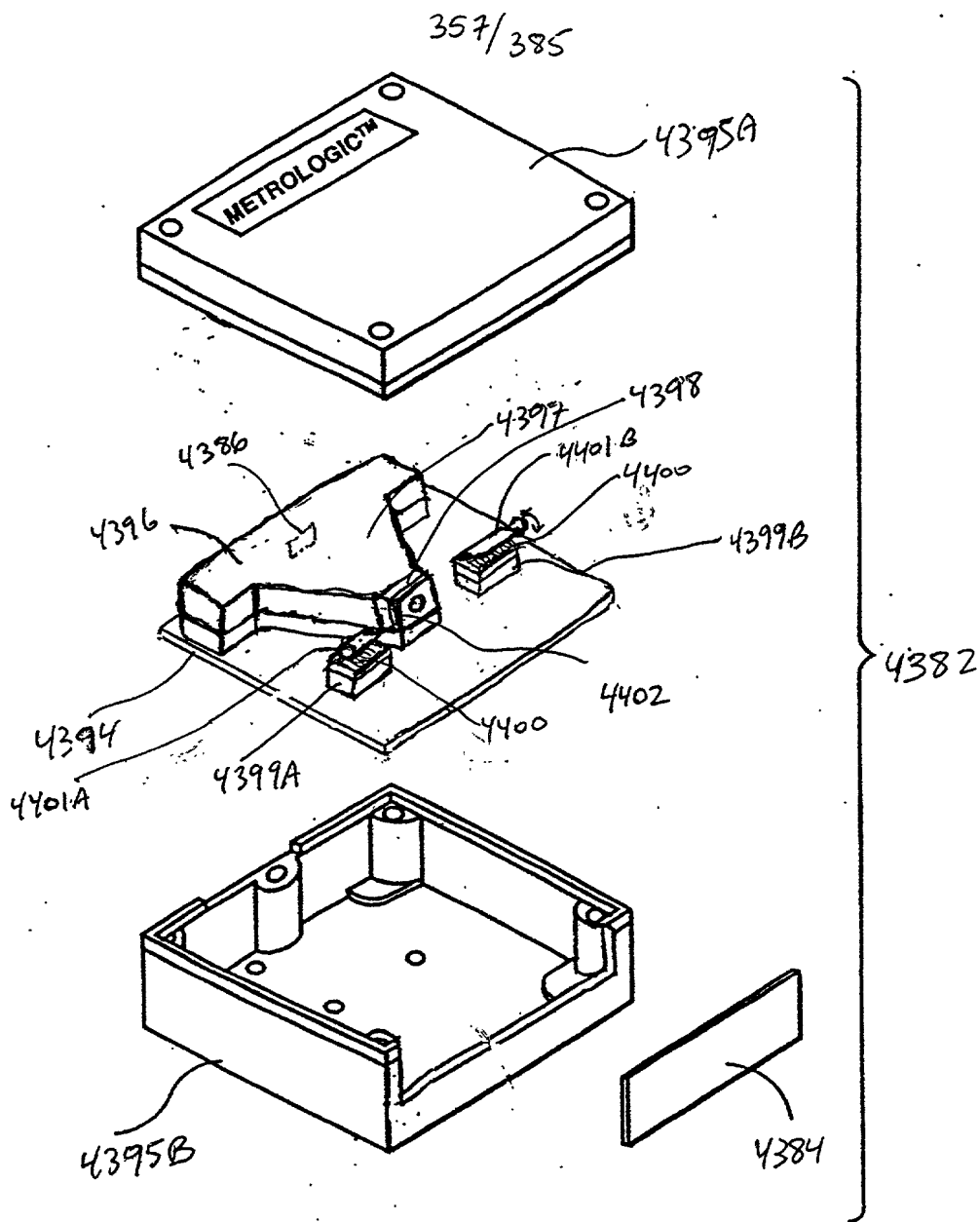


FIG. 64B

* E-optical
Shutter Before
EP Lens
Fig. 1E24A

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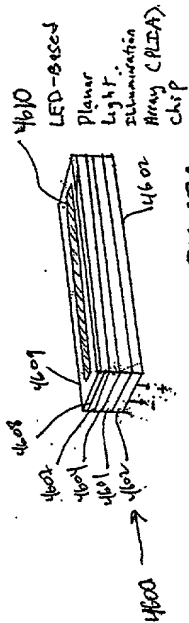


FIG. 67A

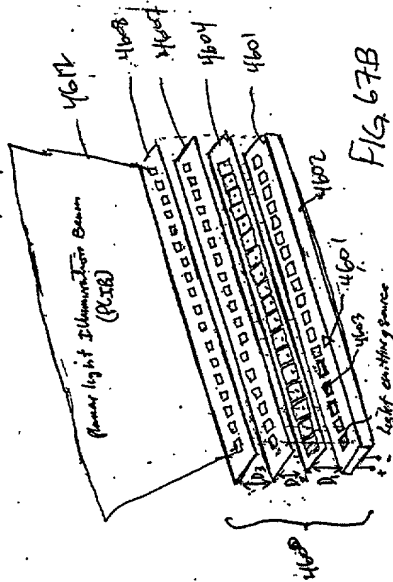


FIG. 67B

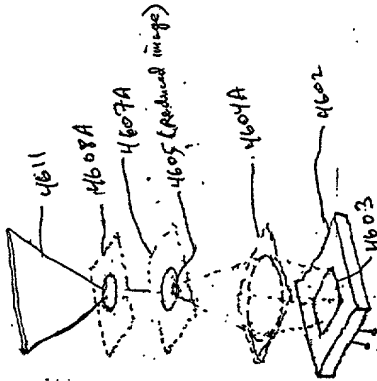


FIG. 67C

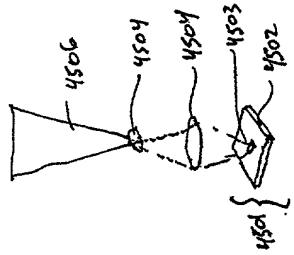


FIG. 65B

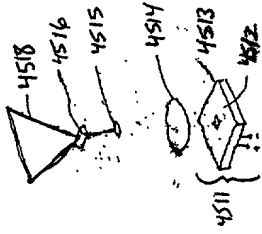


FIG. 66B

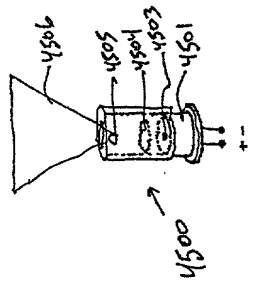


FIG. 65A

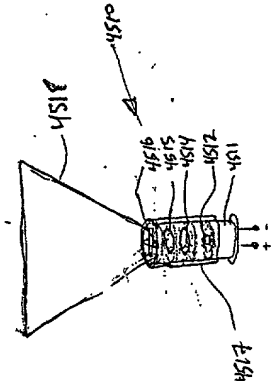
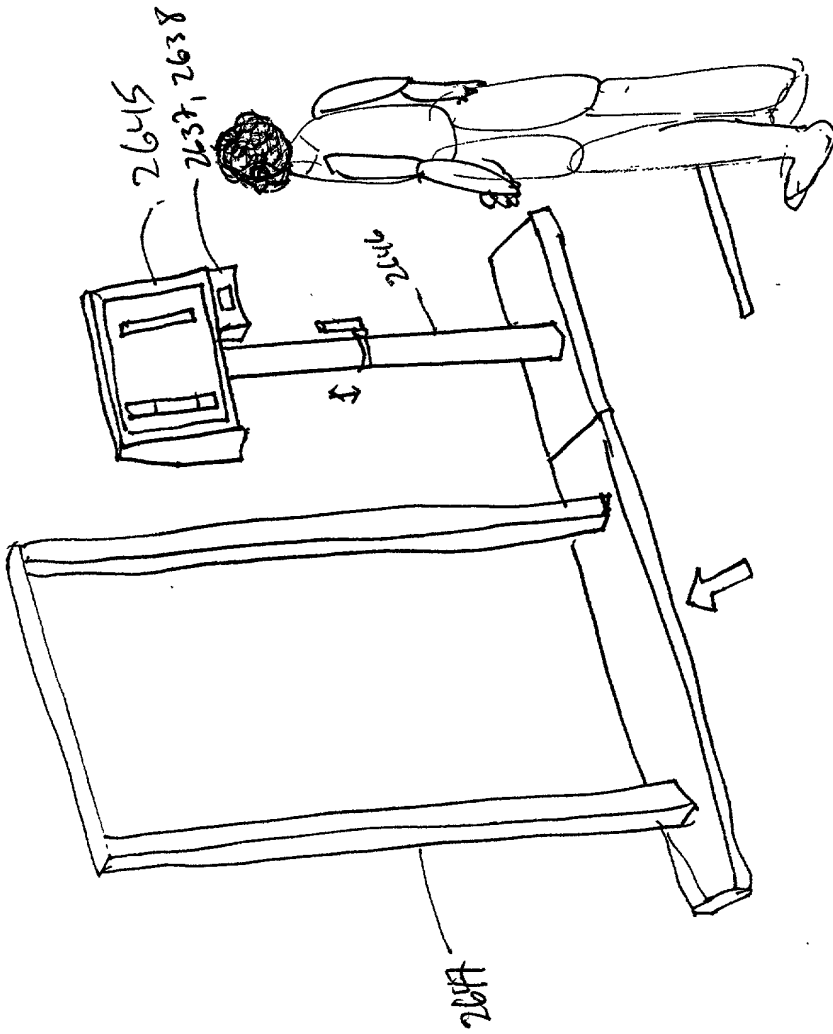


FIG. 66A





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FIG. 68A

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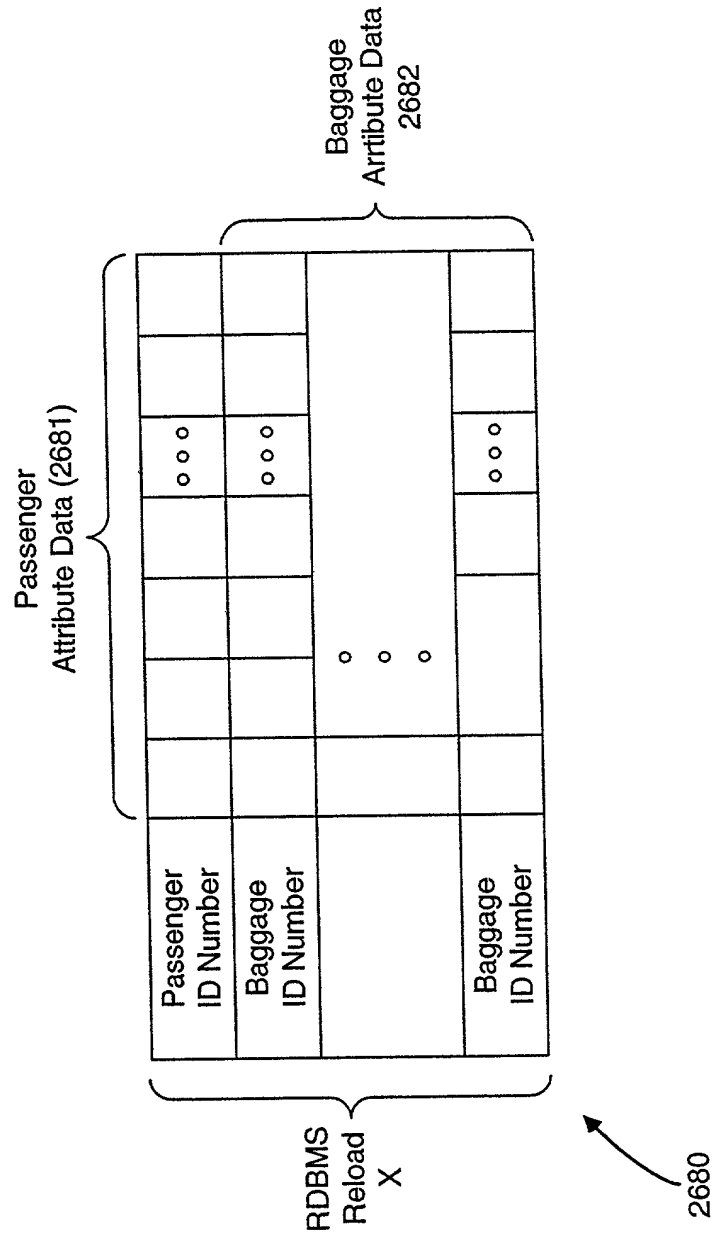


FIG. 68B

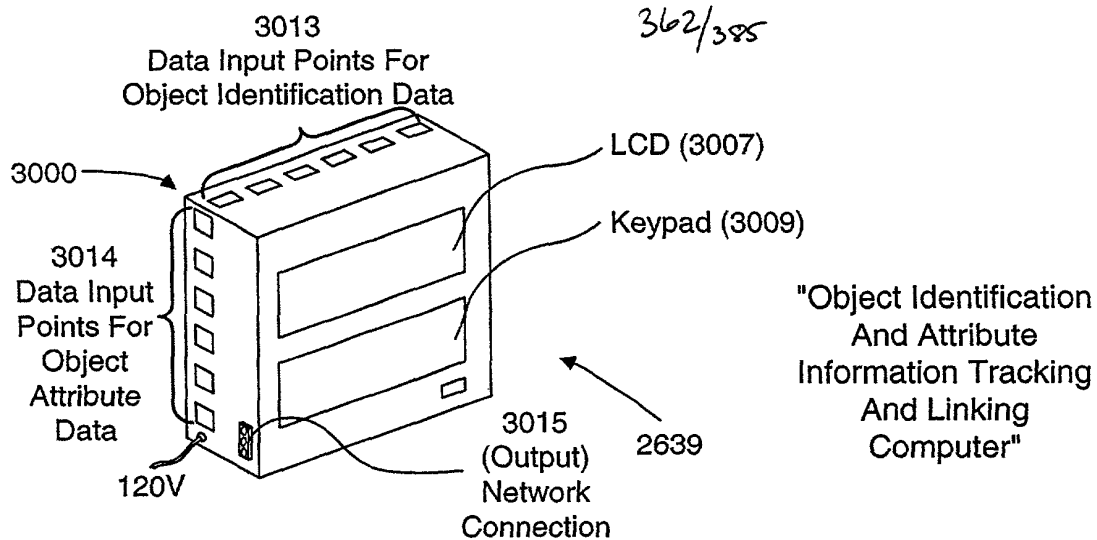


FIG. 68C1

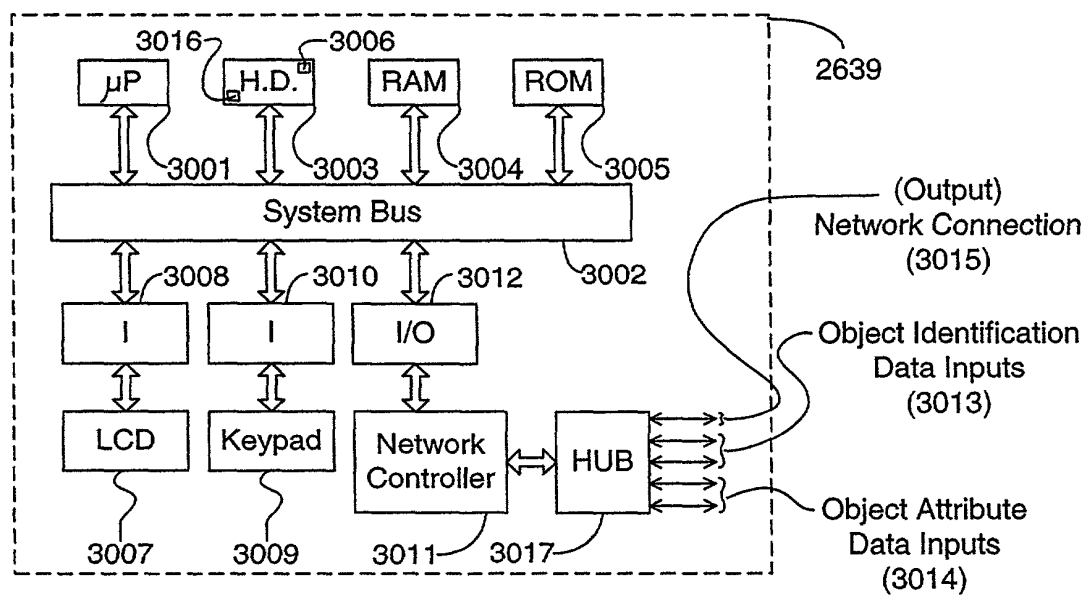
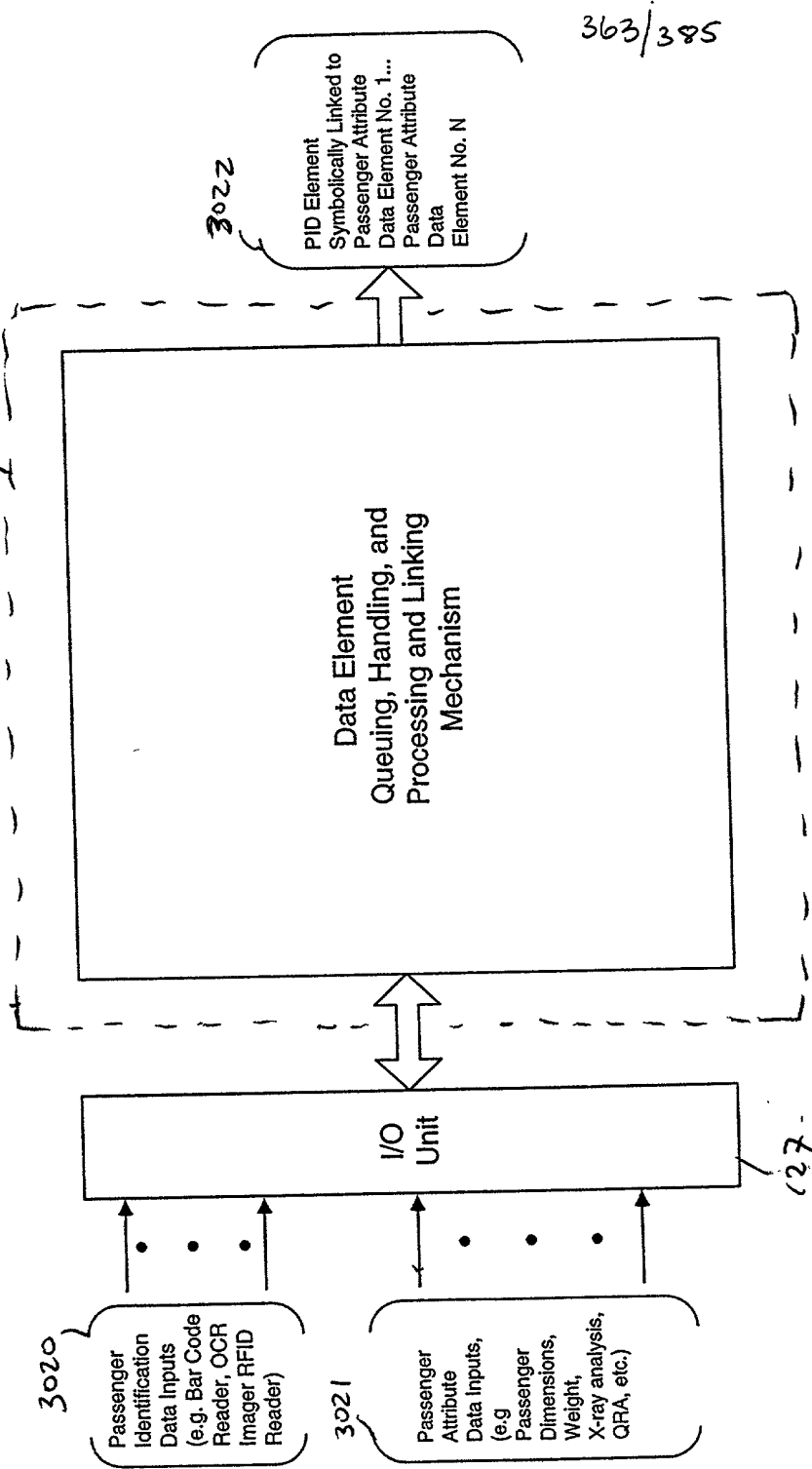


FIG. 68C2

Object Identification And Attribute Information Tracking And Linking Computer System.



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FIG. 68C3

Data Element Queuing, Handling, and Processing Subsystem Employed In The Object Identification And Attribute Acquisition System Of The Present Invention. (131)

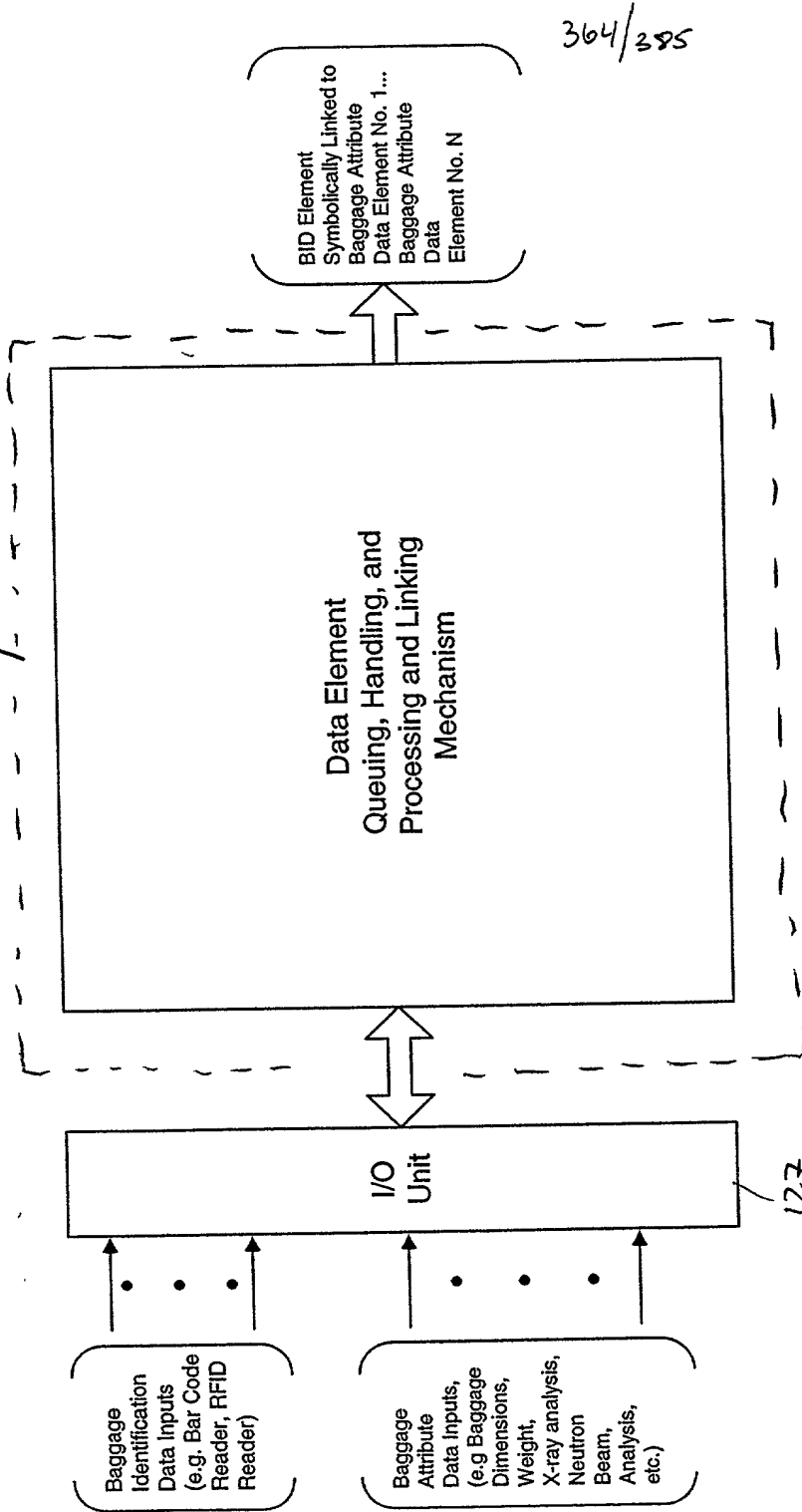


FIG. 68C4

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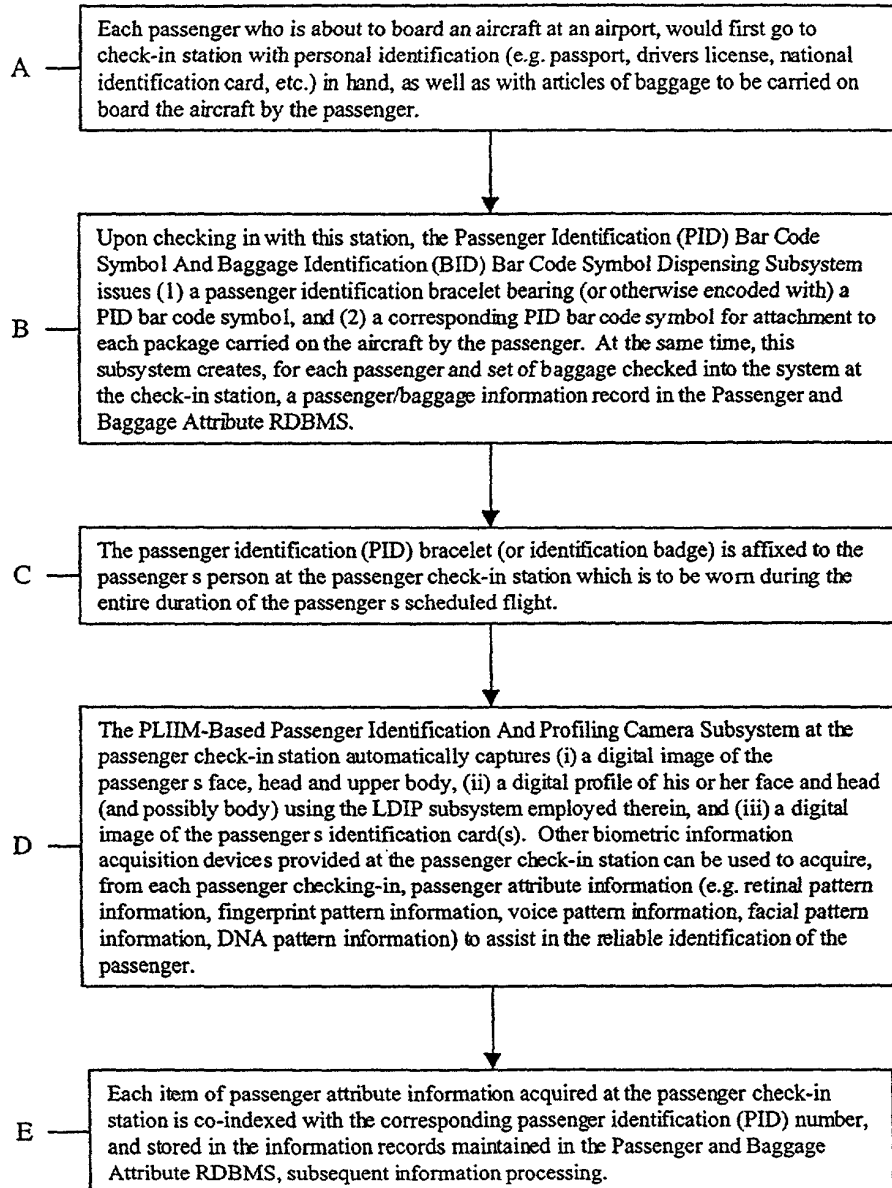


FIG. 68D1

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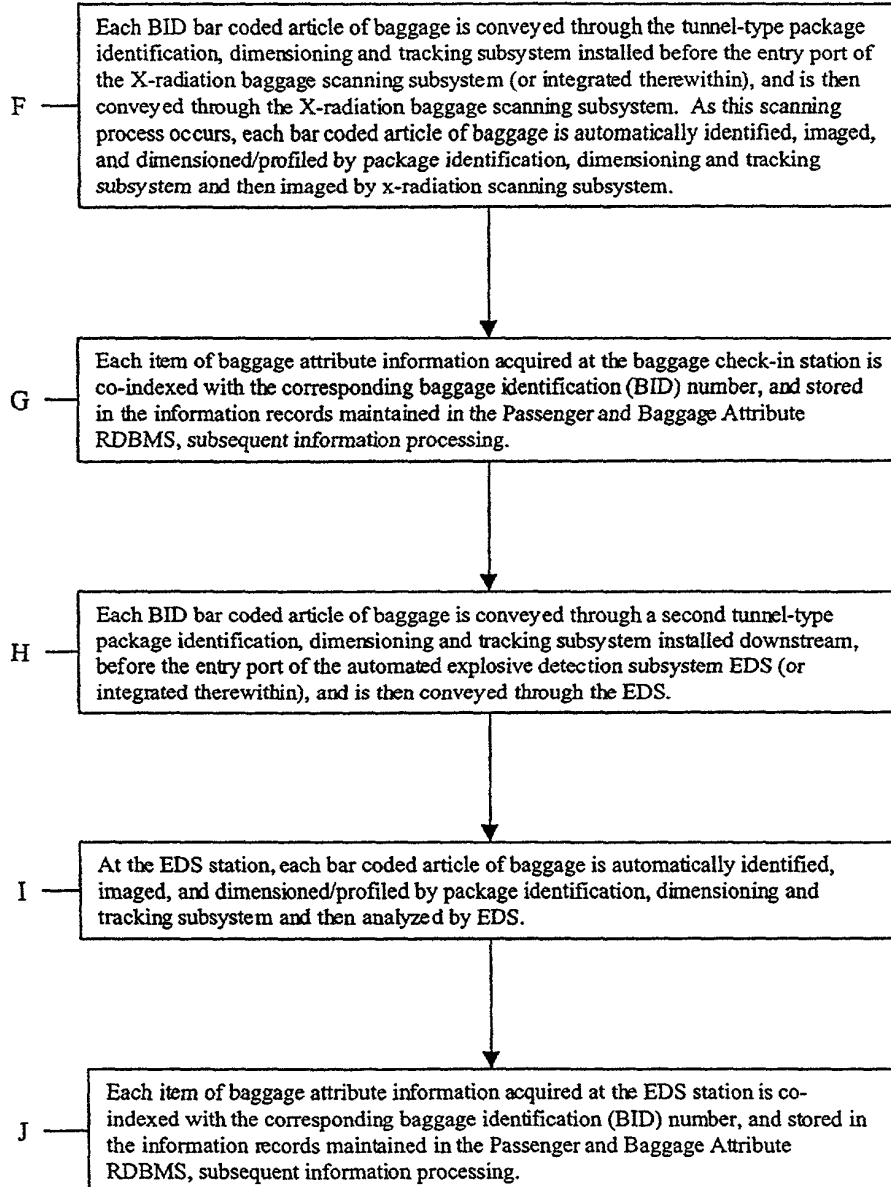


FIG. 68D2

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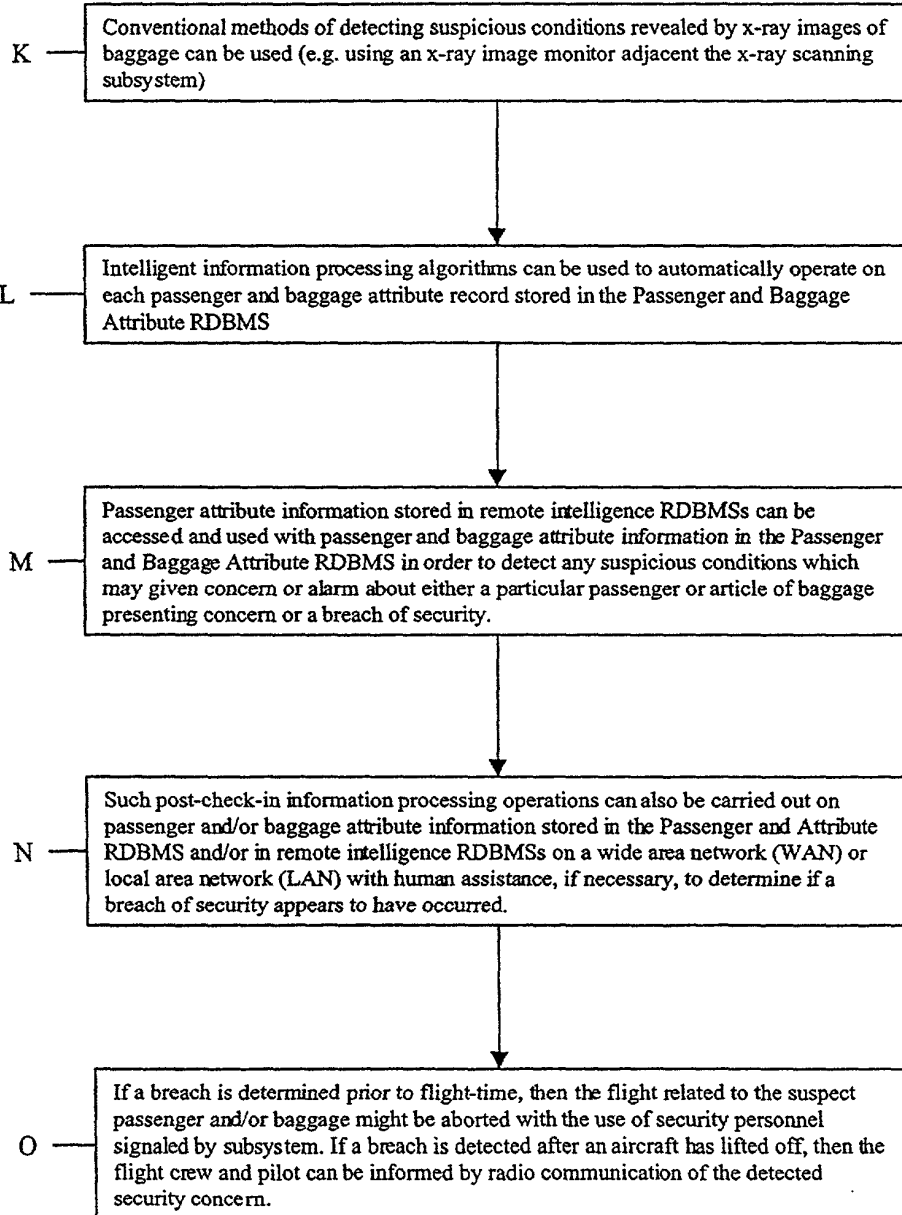
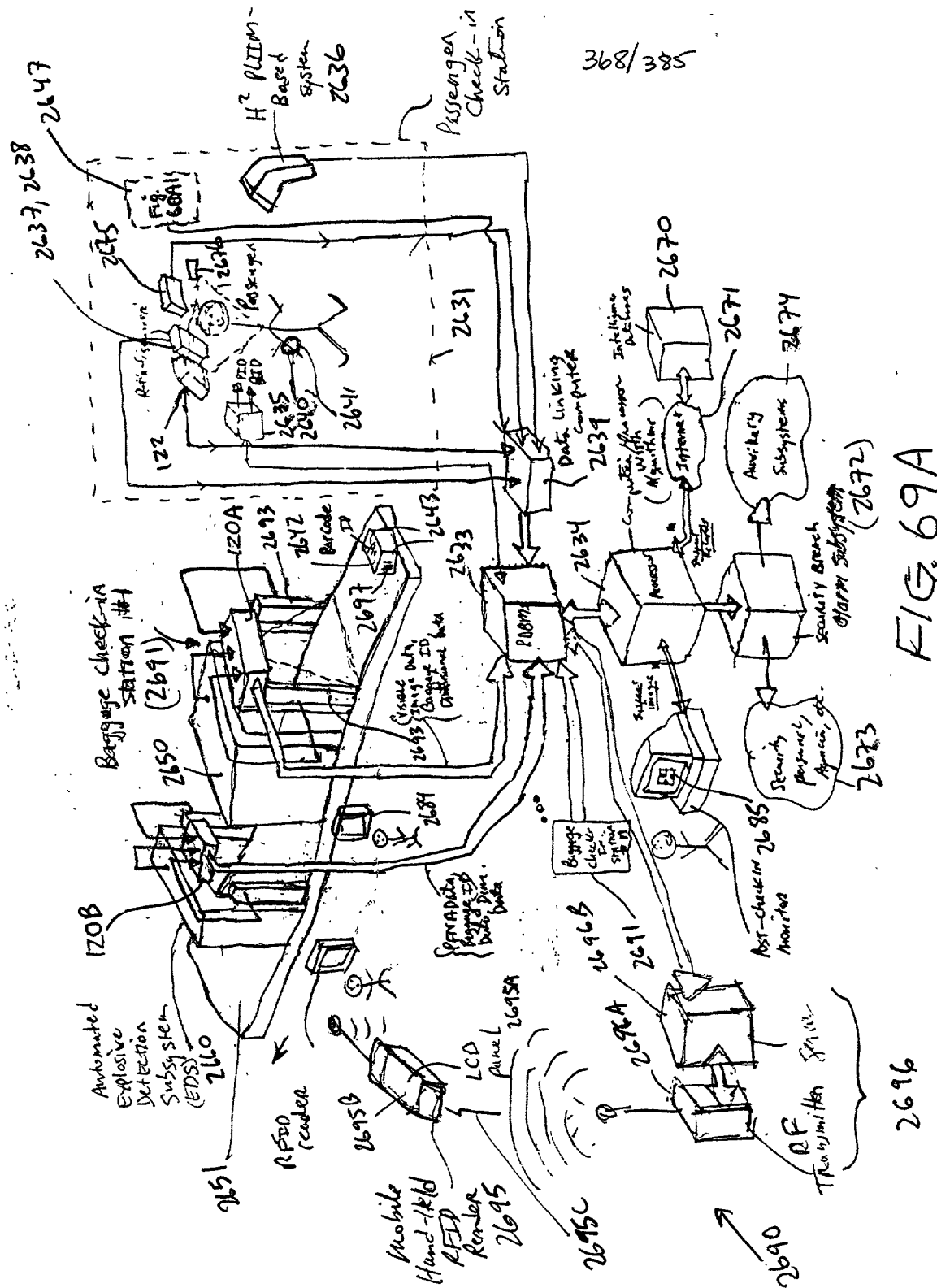


FIG. 68D3



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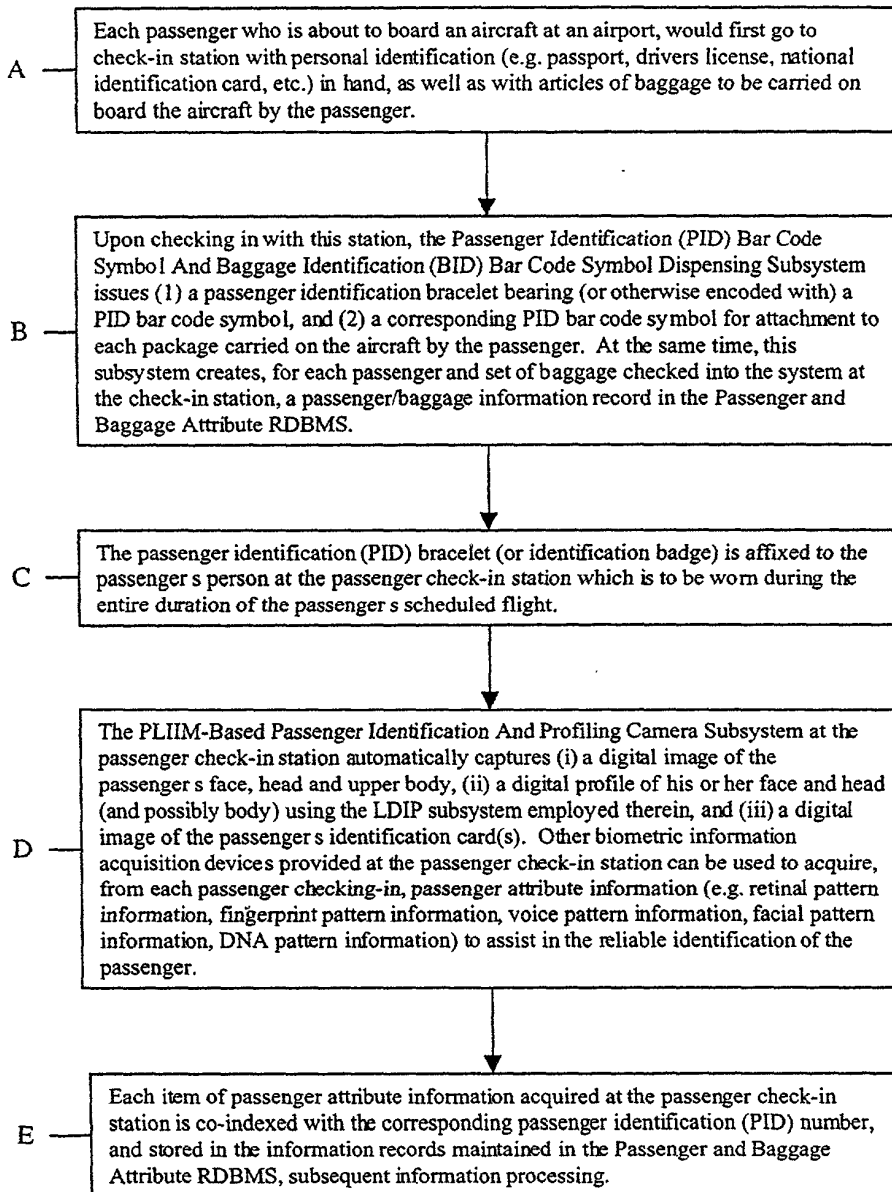


FIG. 69B1

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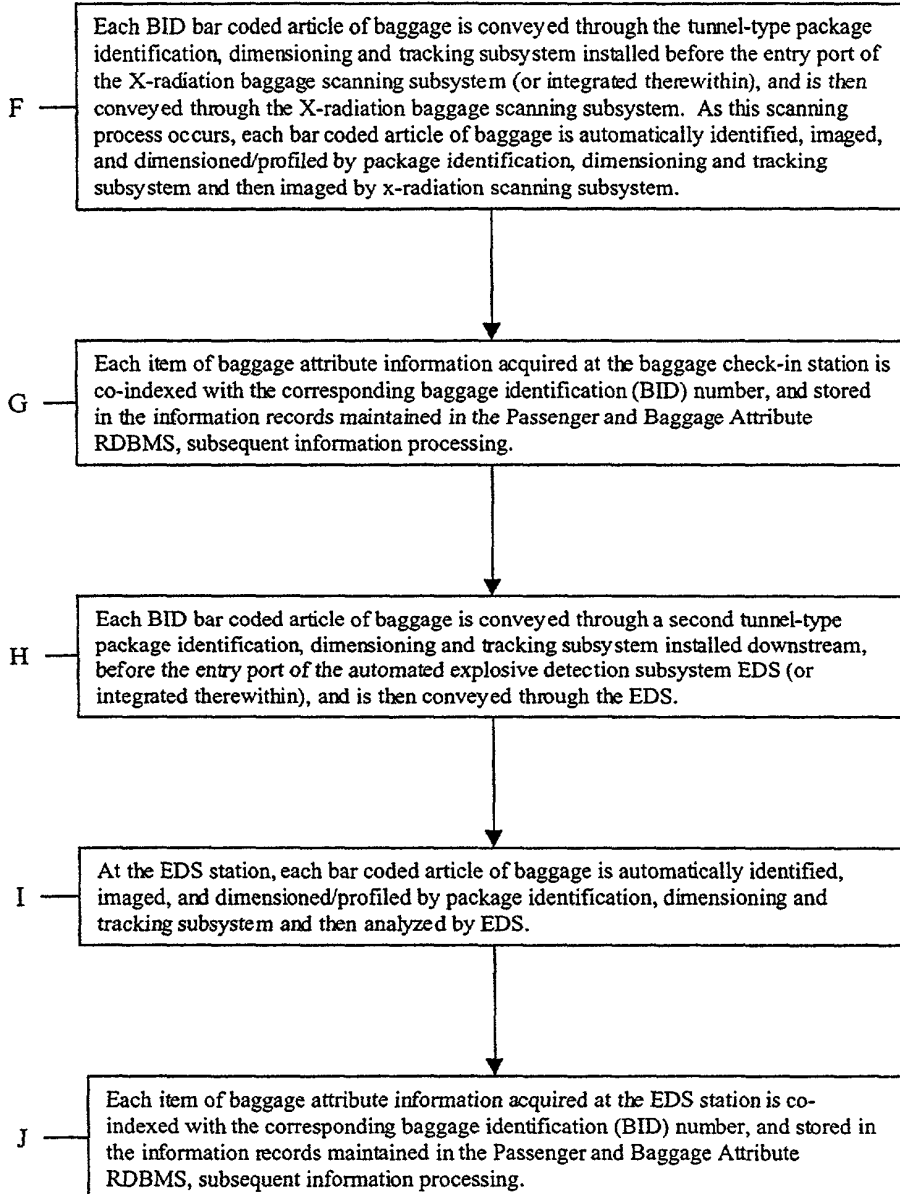


FIG. 69B2

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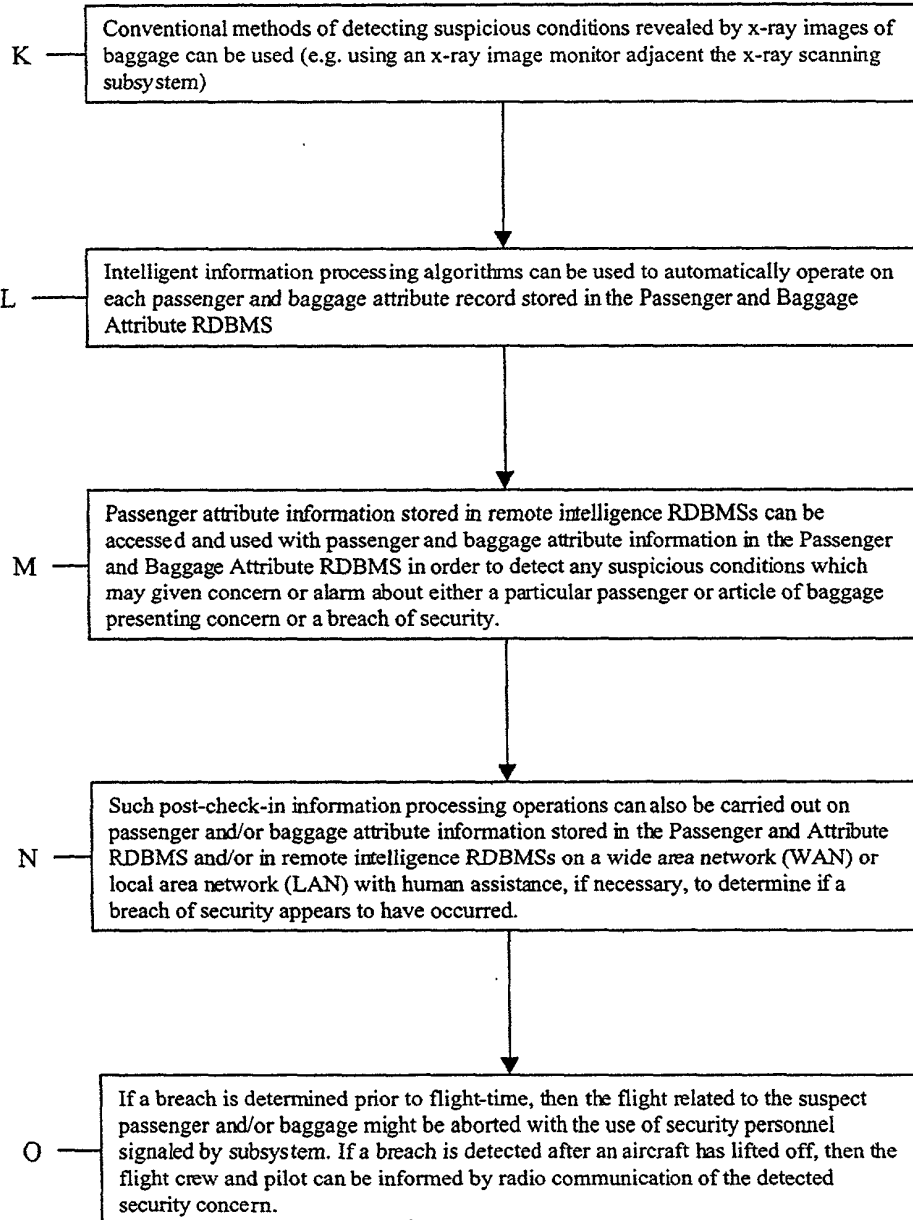
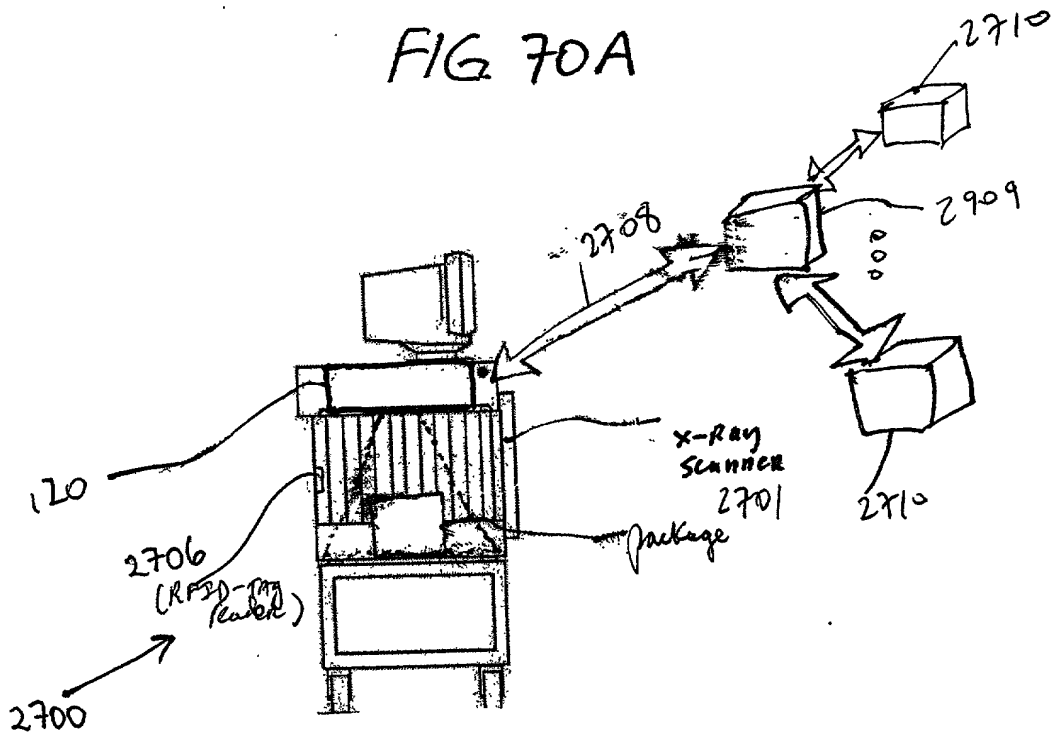
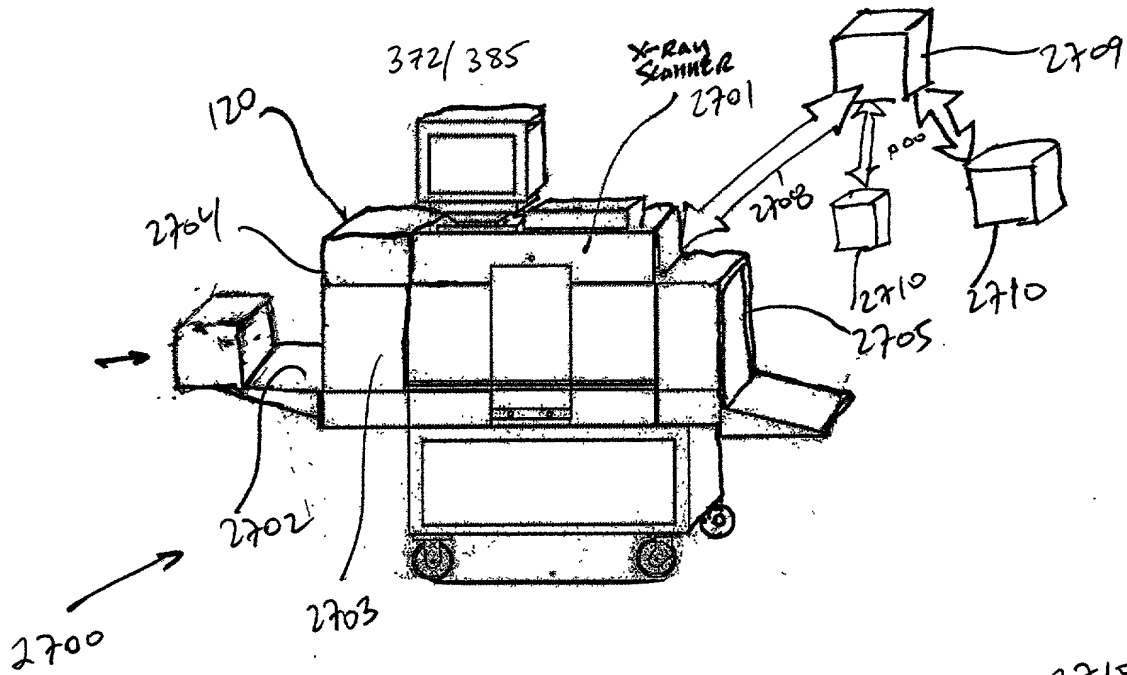


FIG. 69B3



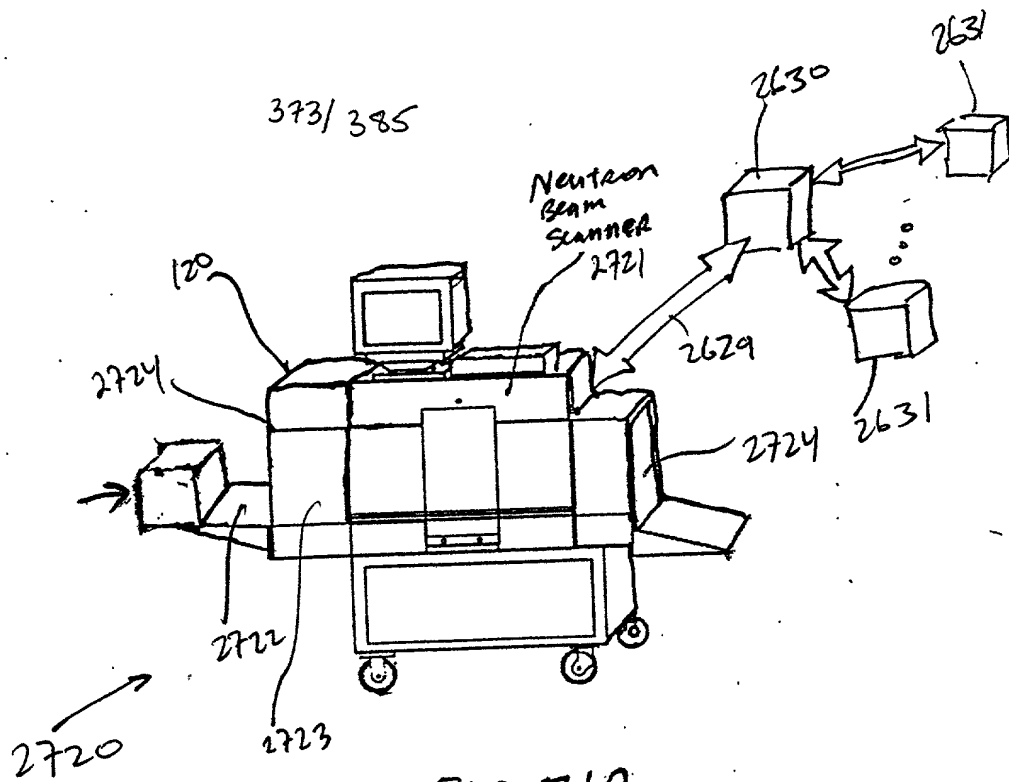


FIG 71A

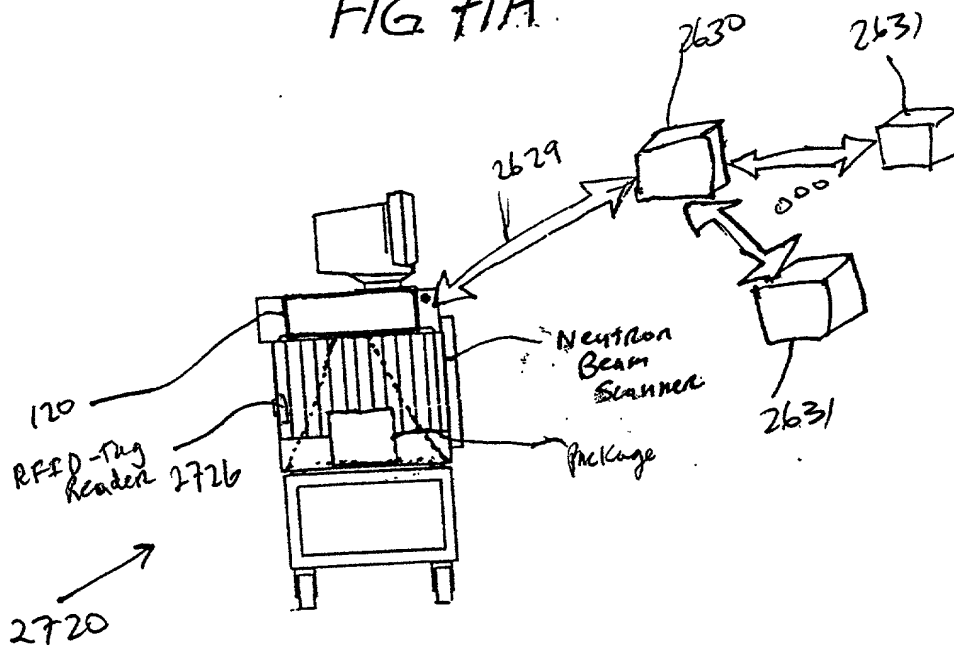


FIG 71B

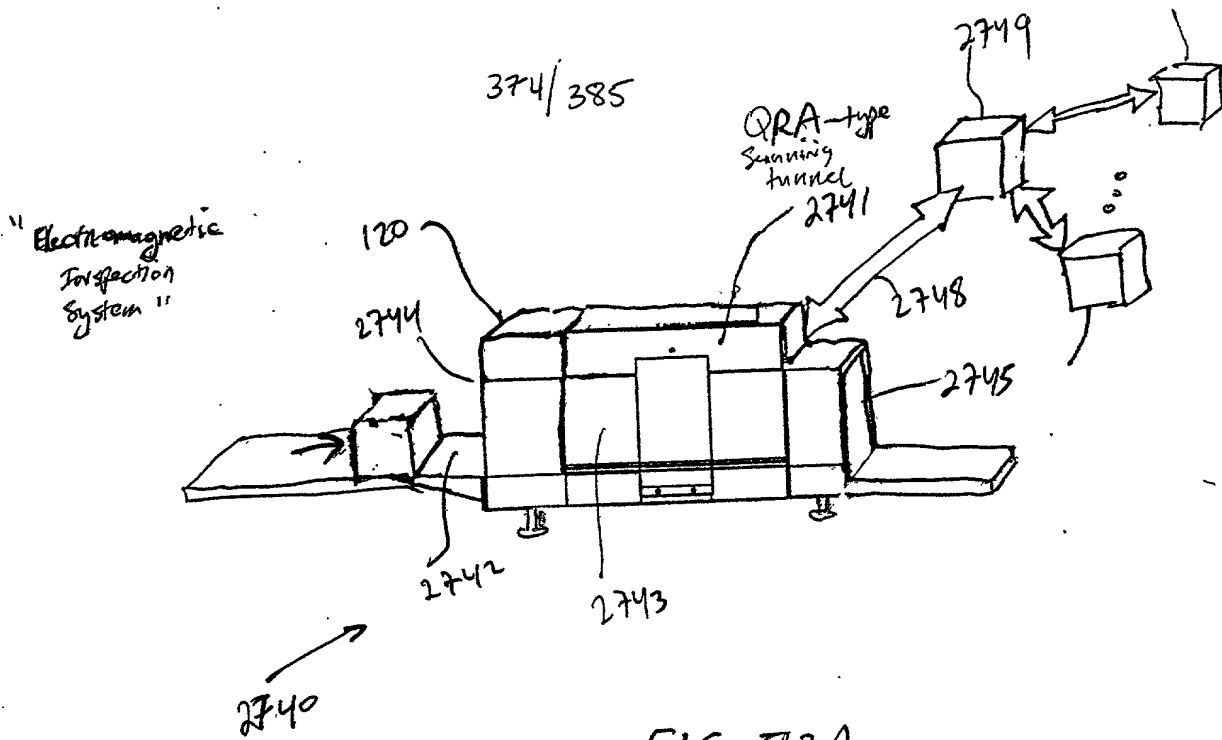


FIG 72A

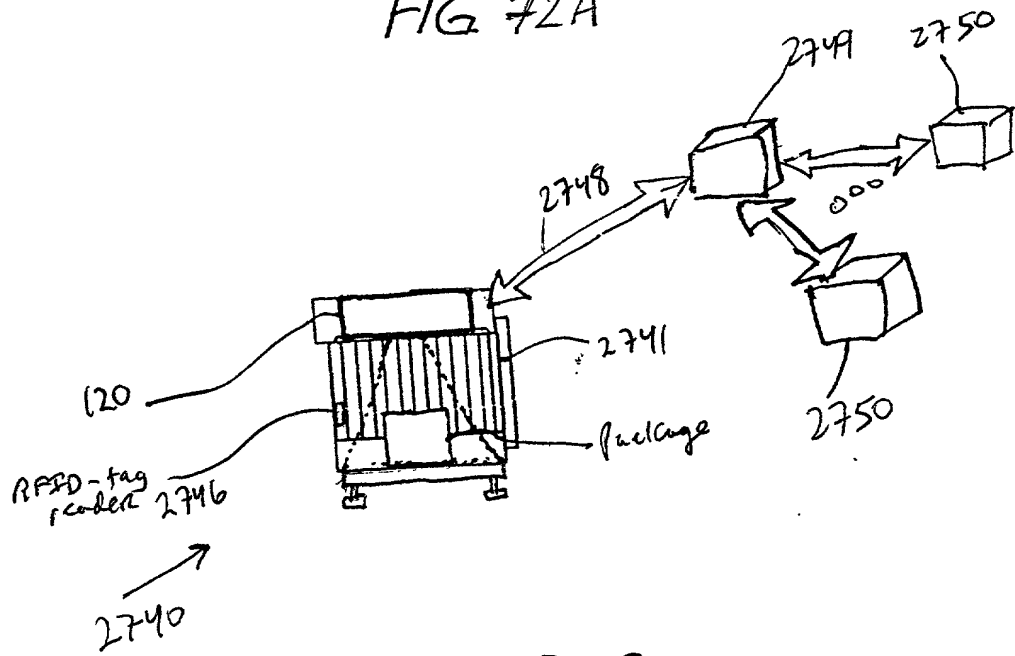


FIG. 72B

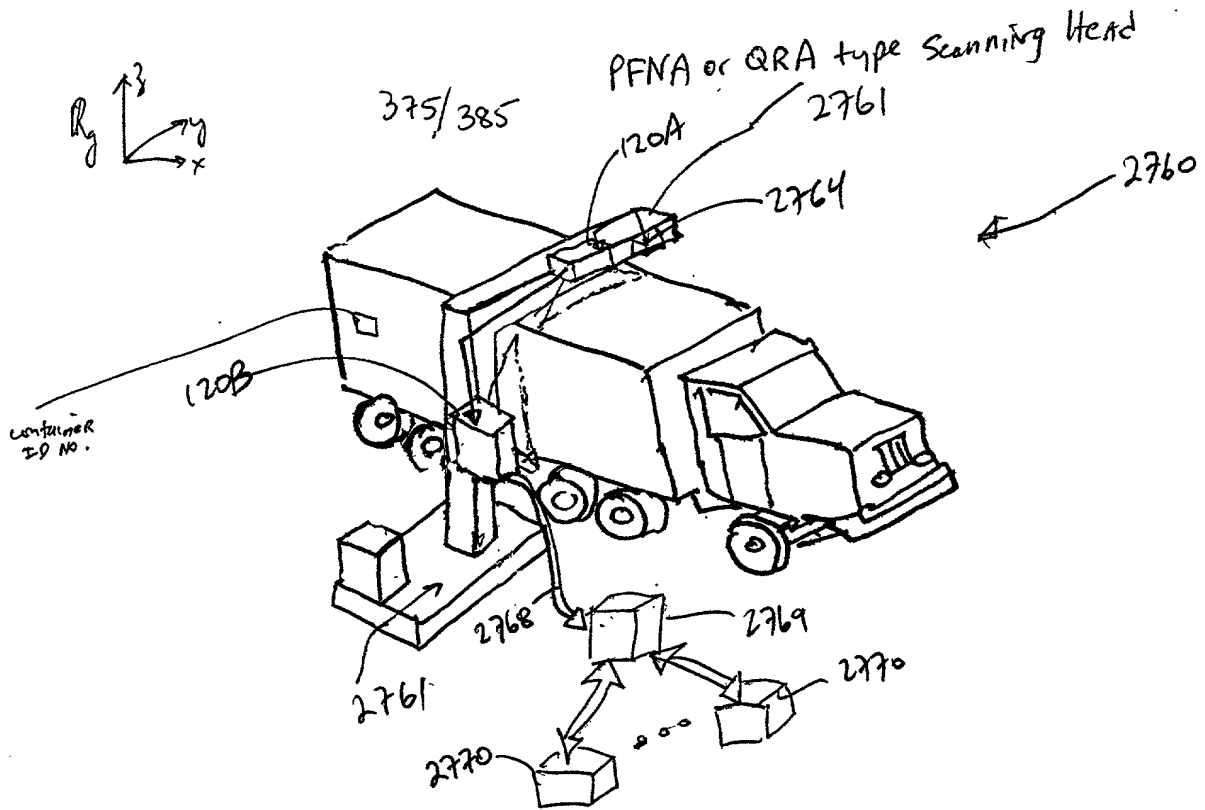


FIG. 73

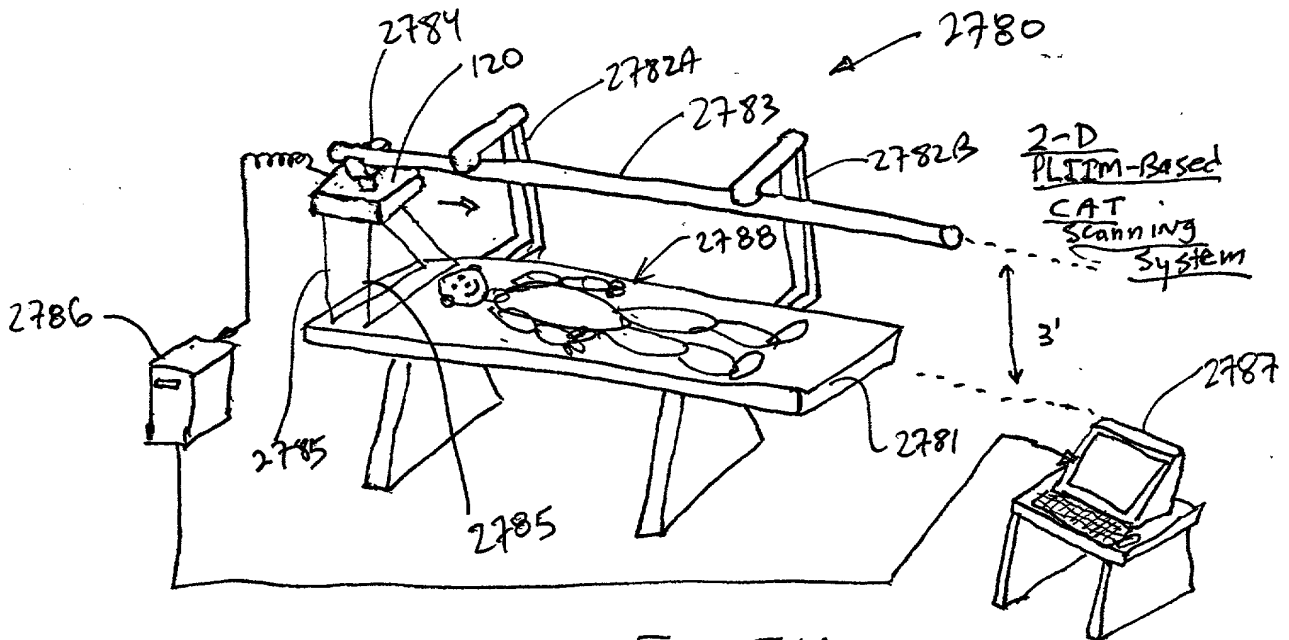


FIG. 74

3-D PLIM-Based CAT Medical Scanning System

FIG. 75

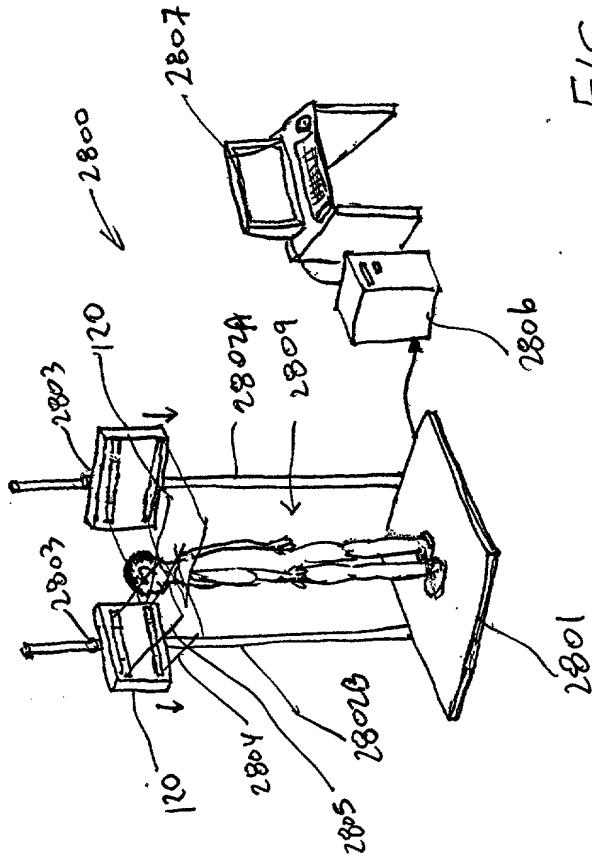


FIG. 76

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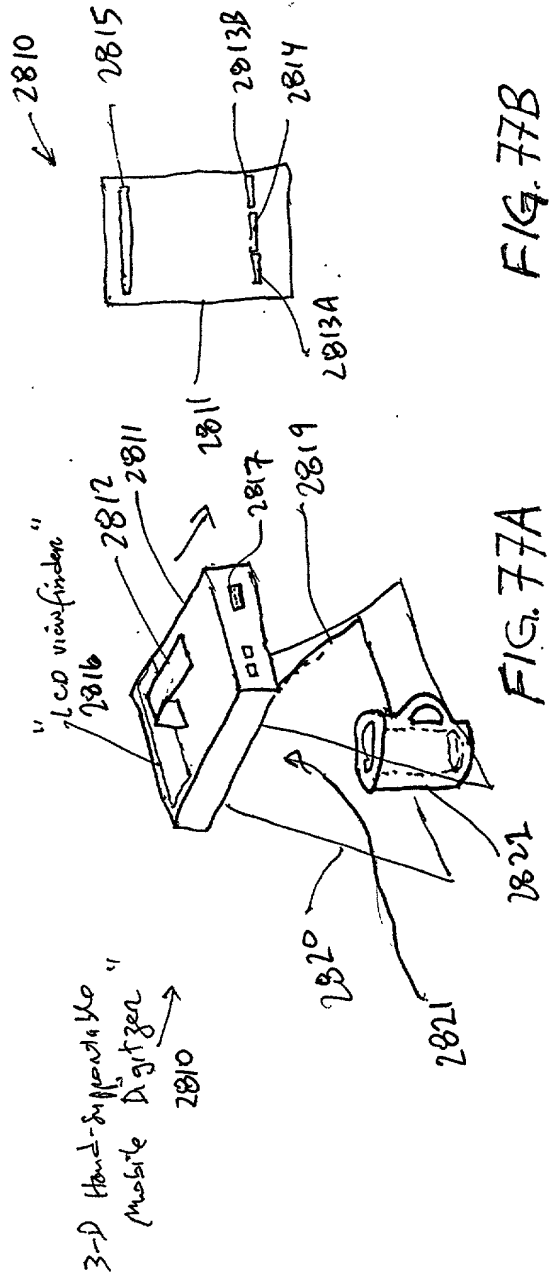
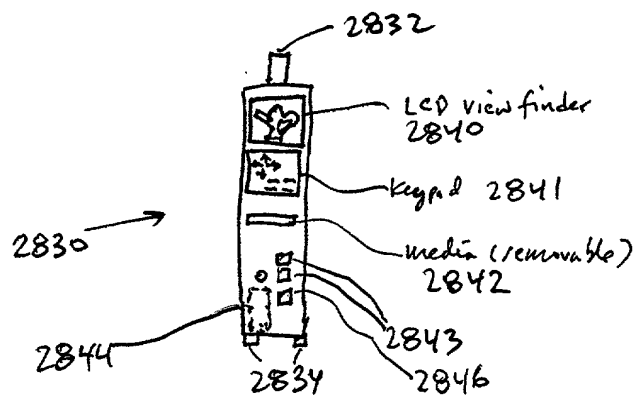
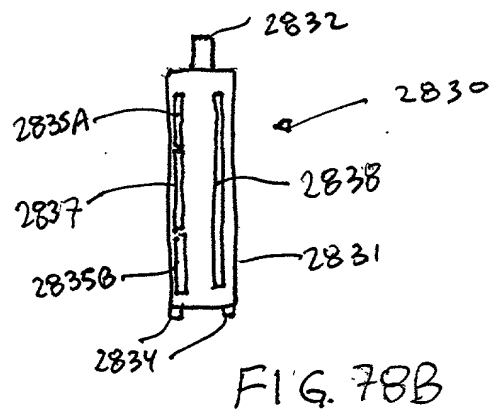
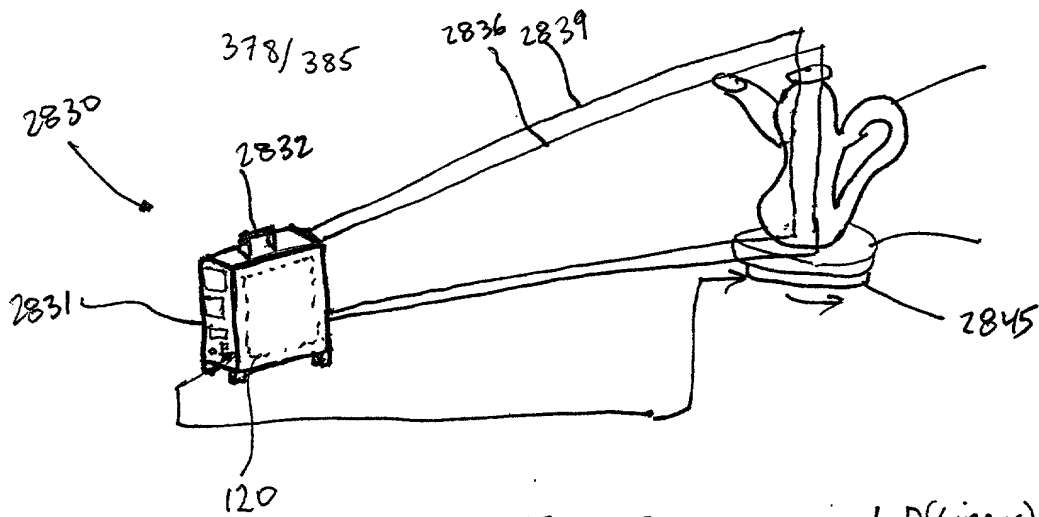
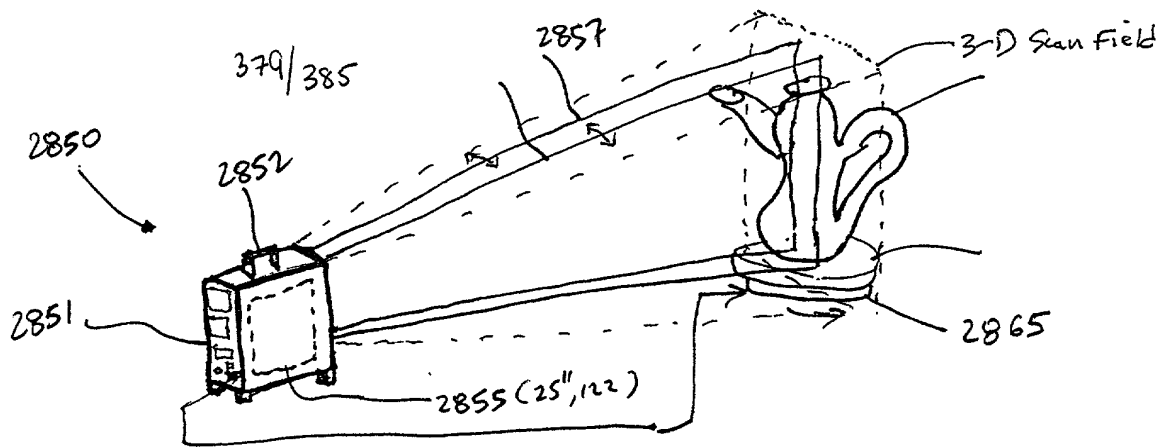


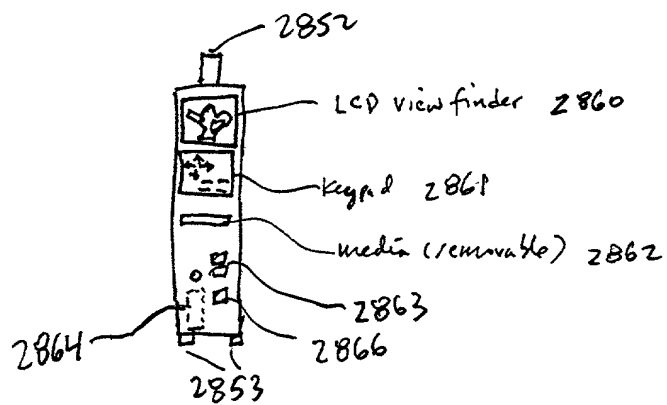
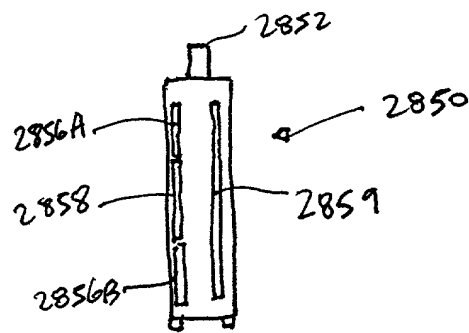
FIG. 77A

FIG. 77B





Z-D (Area) : sensor



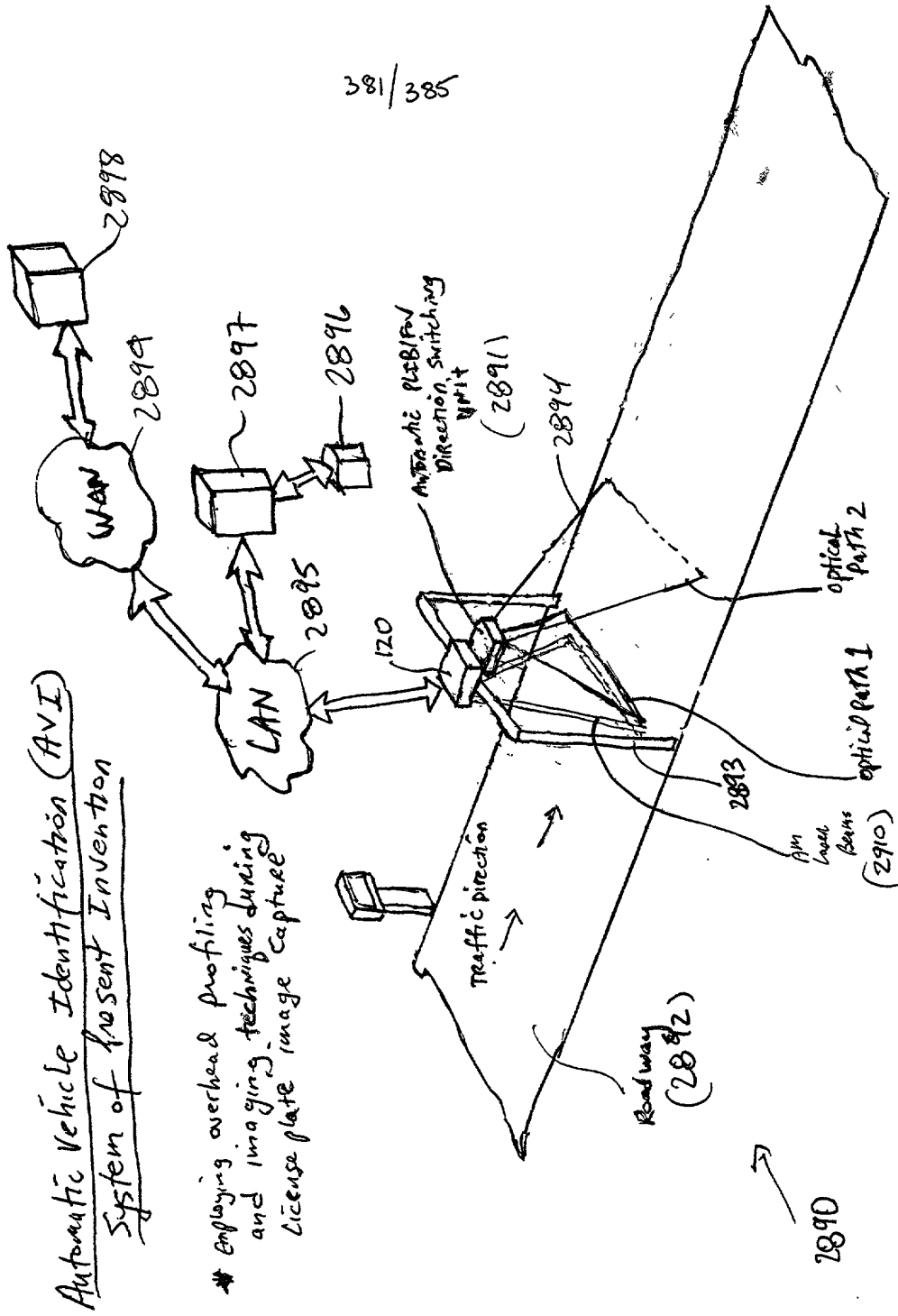


FIG. 81A

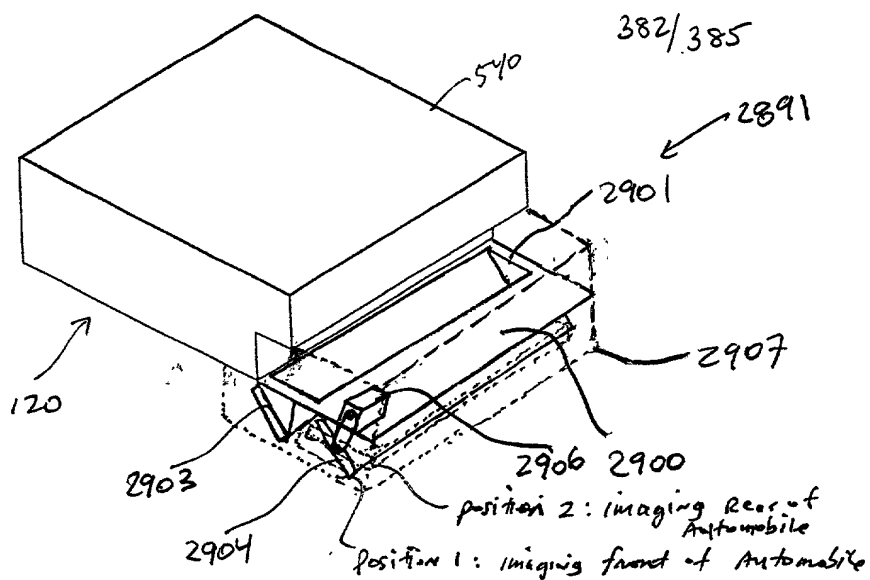


FIG. 81B

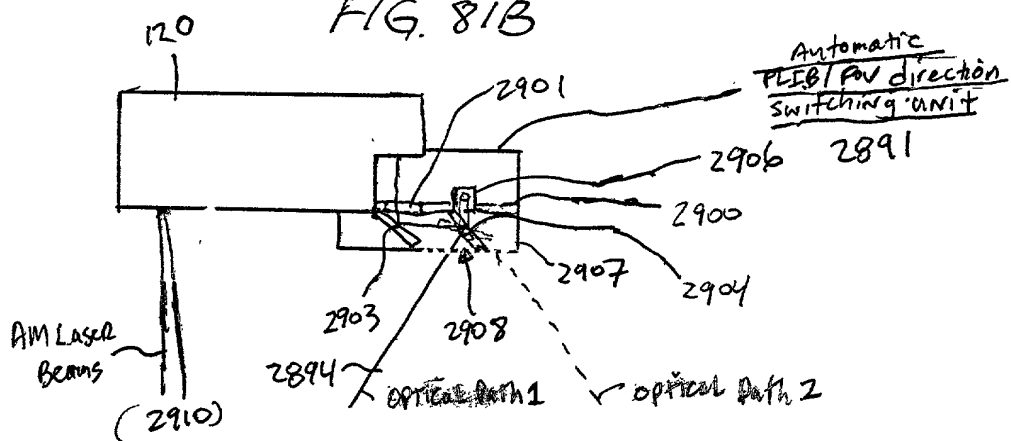
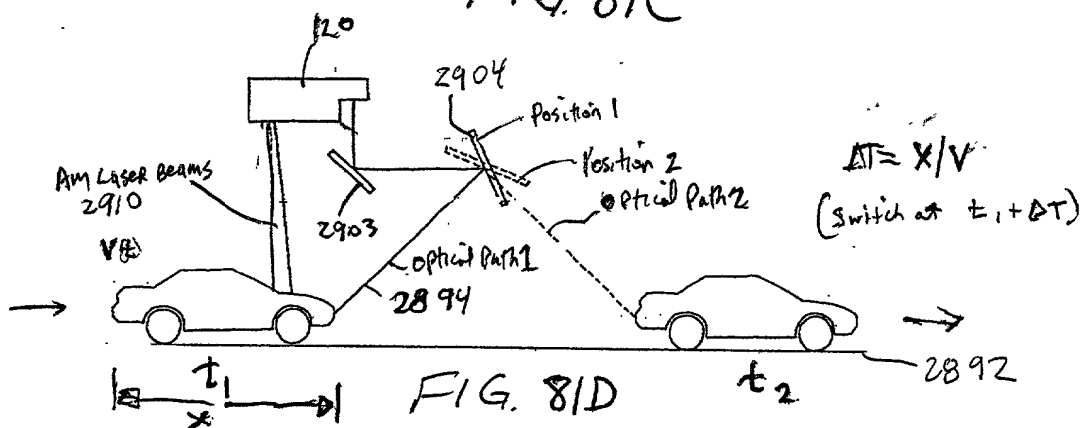
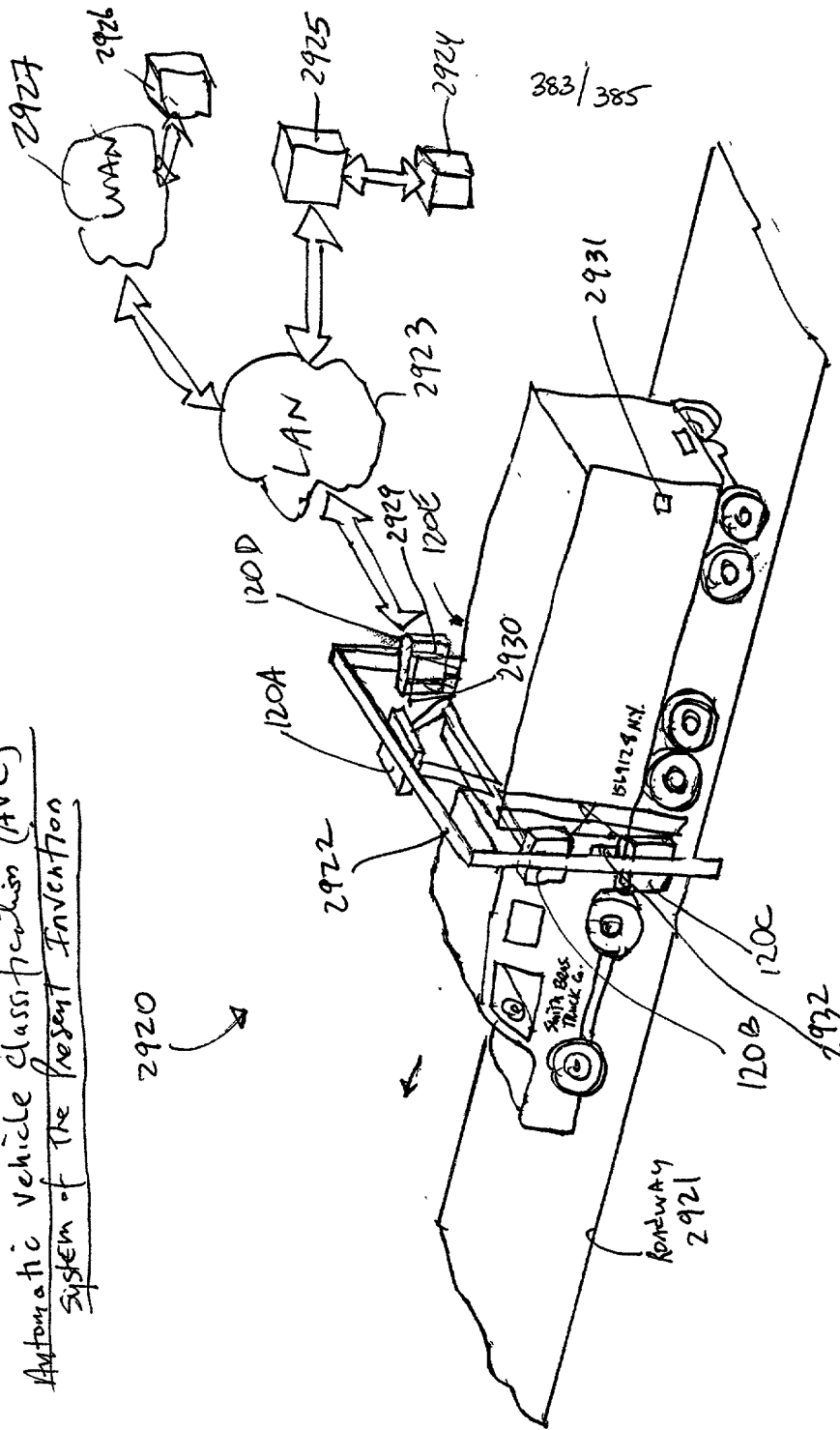


FIG. 81C



Automatic vehicle classification (AVC)



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